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ABSTRACT

This guide is designed as a tool to help teachers provide a variety of activities to meet the needs of students taking seventh grade life science. The guide is written to correlate with the textbook "Exploring Living Things" (Laidlaw publishers) and the related laboratory manual. As a guide, the curriculum may be used according to each teacher's individual situation; in some instances the teacher may concentrate only on activities that emphasize basic concepts, while in other situations the teacher may wish to go beyond the basics and emphasize advanced material and activities. Each chapter is represented in the guide with the major concepts to be taught, instructional objectives, and suggested activities. Additional activities which may be reproduced are included at the end of each chapter and in an appendix. Knowing there is not a "typical student," the guide simplifies methods for teaching a variety of student abilities by coding different levels of involvement. Symbols are used to identify assessments and activities: (1) considered to be essential learner outcomes; (2) requiring minimal reading skills for students with learning disabilities; and (3) involving more complicated work and indepth research. (JN)

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MIDDLE SCHOOLS

SCIENCE

GRADE SEVEN

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L I F E S C I E N C E

Grade 7



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FOREWORD

We live in a world profoundly affected by science and technology. Most students in the seventh grade are beginning their first formal course in science and need to be nurtured tenderly to maintain their interest in science and to develop skills that will serve them in further educational development. Let's all work to make this beginning truly an "eye and mind opening" experience rather than a collage of facts that leaves students looking toward an end of the tenth grade when they can be "through with science."

The texts that we use were written for courses designed for one year of instruction, guard against the tendency to try to teach too much simply because it is there. Make the most of the copious materials to choose those topics in individual classrooms. Be more concerned with skills-communication, observation, data collection and interpretation, prediction-rather than with the retention of facts. This course of study prepared by a group of teachers was written to assist you to do this.

For this age student, the process of how the student learns is more important than what he learns. Your classrooms should be filled with living plants and small animals; the district provides many of these and students need the responsibility of "tending" something alive and observing its development. Each class period should involve some type of laboratory activity and students must be participants, not spectators.

You are encouraged to use all current materials you can obtain. You are especially encouraged to use those elements in the child's environment which are relevant. Emphasis should center around the total ecology of our environment and a student should leave the science courses with an appreciation for all ecological relationships.

The controversies that receive publicity in the news media concerning evolution and family life education can be starting events for meaningful instruction in these areas. Evolution is treated as a theory in this text and you must be careful to see that your instruction emphasizes the aspect of a theory. All of us are committed to the fact that organisms change in response to their environment and those organisms which have genetic factors enabling them to make the most effective change are the ones that live and reproduce. Beyond this there are many conflicting views of evolution. One of your goals as a teacher should be to develop an objective attitude on the part of the student toward this and other controversial ideas.

You are teaching science. Hopefully you are in your classroom because you like science and also young people. When these seventh-graders finish this course, will they like science and you?

Marcile Hollingsworth
Director, Science

ABOUT THIS GUIDE

This guide is intended to be a workable tool helping the teacher provide a variety of activities to meet the needs of the students taking seventh grade Life Science. The guide is written to correlate with the text, Exploring Living Things, by Laidlaw and the related laboratory manual, Activities for Exploring Living Things. As a guide, this curriculum may be used according to each teacher's individual situation. In some instances the teacher may wish to concentrate only on activities that emphasize the basic concepts, while in other situations the teacher may wish to go beyond the basics and emphasize advanced materials and activities. Most classrooms, though, consist of students whose abilities and skills cover a wide range, and teachers will need both basic and advanced material to adjust for individual differences. Hopefully, this guide will help alleviate some of these problems and allow the teacher flexibility in lesson planning.

Each chapter is represented in the guide with the major concepts to be taught, instructional objectives, assessment guidelines, available materials and resources, and suggested activities. Additional activities which may be reproduced at the school are included behind each section and in an appendix to further aid the teacher in providing fun and interesting ways to involve the students. However, the activities listed are merely suggestions and may be utilized depending on the particular situation.

Special symbols have been placed by certain assessment guidelines and suggested activities. Knowing there is not a "typical student," this guide simplifies methods for teaching a variety of student abilities by coding different levels of involvement.

- The symbol E identifies assessments and activities considered to be essential learner outcomes. Each student should master these areas before leaving seventh grade Life Science.
- The symbol * identifies assessments and activities requiring minimal reading skills for students with learning disabilities.
- The symbol @ identifies assessments and activities that involve more complicated activities and indepth research.

SEVENTH GRADE - LIFE SCIENCE

Scope and Sequence: Semester I	Time
Unit 1. Introduction	20 days
Chapter 1 How Living Things are Studied	
Chapter 2 What Does "Being Alive" Mean?	
Chapter 25 How Life May Have Begun	
Chapter 4 Classifying Living Things	
Unit 2. Ecology: The Science of Survival	25 days
Chapter 5 Two Problems in Ecology	
Chapter 6 The Physical Environment	
Chapter 7 The Biological Environment	
Chapter 8 Some Natural Changes	
Chapter 9 Conservation and Natural Resources	
Unit 3. Cells and Protists: Microscopic Study	12 days
Chapter 3 Cells: Small Packages of Life	
Chapter 10 Protists	
Unit 4. Animal Kingdom: The Eating Kingdom	28 days
Chapter 4 Classifying Living Things*	
Chapter 15 Sponges and Coelenterates	
Chapter 16 Worms	
Chapter 17 Mollusks, Arthropods and Echinoderms	
Chapter 18 Fish, Amphibians and Reptiles	
Chapter 19 Birds and Mammals	
*Review and Evaluation	<u>5 days</u>
TOTAL	90 days

SEVENTH GRADE - LIFE SCIENCE

Scope and Sequence: Semester II

Time

Unit 5. The Human Body: A Study of Yourself	40 days
Chapter 20 Protection, Support and Movement	
Chapter 21 Digestion and Excretion	
Chapter 22 Respiration and Circulation	
Chapter 23 Control and Regulation	
Chapter 24 Reproduction	
Unit 6. Heredity and Change	10 days
Chapter 26 Heredity and Change	
Chapter 27 Changes and Development	
Chapter 28 Searching into the Past	
Unit 7. Plant Kingdom	25 days
Chapter 4 Classifying Living Things*	
Chapter 11 Algae, Fungi, and Lichens	
Chapter 12 Mosses and Ferns	
Chapter 13 Gymnosperms	
Chapter 14 Flowering Plants	
Unit 8. Addictives: Alcohol, Tobacco, and Drugs	10 days
Use of Pamphlets, Library Research, Panel	
Discussions, Outside Speakers, etc.	
(Not covered by textbook)	
*Review and Evaluation	<u>5 days</u>
TOTAL	90 days

ESSENTIAL LEARNER OUTCOMES

LIFE SCIENCE

Grade 7

The student will -

Given a balance, a metric ruler, a graduated cylinder and a thermometer, determine the mass of an object to the nearest .1 gram, the length of an object to the nearest .1 centimeter, the volume of a liquid to the nearest milliliter and the temperature of the air to the nearest degree Celsius.

Given a microscope and a prepared slide, focus the microscope using the 10x objective and then switch to the proper focus using the 43x objective.

Given a diagram of a simple cell, label the cell membrane, nuclear membrane, nucleus, cytoplasm and vacuole.

Compare a cell from an animal with one from a plant, giving at least three likenesses and two differences.

Given diagrams of the three kinds of bacteria, match the diagram with the correct name.

List two good and two harmful effects of bacteria.

Give the distinguishing characteristics of members of the protista kingdom and give the names of two protists.

Given a list of substances, identify for the process of photosynthesis those which are:

- A. Raw materials
- B. Source of energy
- C. Catalyst
- D. Food product
- E. By-product

Give the function of the flower on a plant and give two uses of the product of the flower.

Explain why the successful growth of plants is essential to man.

Given a list of functions, identify those performed by the skeletal, circulatory, digestive, respiratory, excretory and nervous systems of the human body.

Given a list of major organs, identify those belonging to the skeletal, circulatory, digestive, respiratory, excretory, and nervous systems of the human body.

List four things that can be done to avoid infectious diseases.

List five general things that can be done by a person to stay healthy and grow normally and then list five things that if done, will make it difficult for a person to grow and stay healthy.

Given an oral thermometer, obtain your own body temperature and decide if it is below normal, normal, or above normal.

GENERAL INFORMATION

There is NO laboratory fee for the science student. However, each teacher in the Science Department will be reimbursed for expenditures up to \$10.00 per year for incidentals provided itemized receipts are kept and turned in. This money should be used to buy materials not furnished by the District.

The Science Supply Center at the Central Warehouse keeps in stock some 1600 items that you may requisition as you need them. Your Science Department chairman has a copy of the catalog of science supplies and the requisition forms as well as the knowledge of how these are to be used. We have the materials and we want you to make full use of them as you see fit.

The District furnishes many live supplies that we maintain and ship through our school mail system. Your department chairman will have order blanks for these requests along with instructions for requisition.

Live cultures that we do not maintain must be ordered from a commercial supply house. The paper work to insure delivery requires that your requisition reach the Science Office at least three weeks before the planned delivery date. These may be requested from the Science Office on the regular requisition form, but that requisition must not have any other warehouse items on the requisition.

Live specimen must be cared for properly when they reach your school if they are to remain alive until your students are ready to use them.

SAFETY PRECAUTIONS

The introduction of more and more chemistry into the science curriculum increases the opportunities for students to have accidents and makes it imperative for science teachers to devote more time to the instruction for safe laboratory procedures.

Each teacher must devote adequate time and effort to the the promotion of safety in the classroom and in the laboratory. A set of safety rules and regulations should be carefully worked out, and each student should be furnished a copy of these. Additional time should be spent impressing the rules upon the student. Such rules should be posted in the laboratory and the students instructed as to what should be done in case of an emergency. Following are some general instructions that are essential:

1. Safety goggles must be worn by students and teachers when performing hazardous experiments.
2. Never drink out of laboratory glassware.
3. The best object with which to smother a fire upon the clothing is a laboratory apron; a wet paper towel or cloth will smother a small fire on the desk top. Never attempt to blow out a fire or pour water on a chemical fire.

4. Instruct the students: When chemicals are spilled, dilute them with water. If a chemical is spilled on your body, wash the chemical off with copious amounts of running water.
5. Never allow the students to have access to stock quantities of chemicals; place all chemicals that the students will use in small bottles which are never returned to the stock shelf. Hazardous chemicals, in all quantities, should be kept in locked cabinets away from all students.
6. The teacher should *never* leave a class in the laboratory. If an emergency arises, the group should be returned to the classroom, or another teacher should be called in to supervise the laboratory.
7. The storeroom should always be locked when the teacher is away from the laboratory.
8. Students should not be allowed in the storeroom, except as laboratory assistants. Student assistants must always work under the direction and supervision of a teacher. Have each student who works as a laboratory assistant copy, date, and sign the following statement. It would be wise to have a parent's signature also.

"Serving as a laboratory assistant is a privilege which requires responsible behavior at all times. I will perform *only* those experiments directed and supervised by a teacher and I will not permit others to perform unauthorized experiments.

I know that science supplies and equipment belong in the lab or storeroom. I will not take nor permit others to take such materials from the lab."
9. An adequate first-aid kit must be maintained and the teachers must be adequately trained in the proper procedures needed for the treatment of injuries. The school nurse will be glad to assist in establishing and maintaining excellent first-aid procedures.

It is the responsibility of the teacher to care for and maintain all equipment and to assist in maintaining a clean storeroom and laboratory. All materials should be returned to their proper storage place after use. Stock bottles of chemicals should never be placed in a position where students could possibly contaminate the chemical by returning wrong materials or using dirty instruments. Transfer the chemicals to smaller bottles so that if the chemical is contaminated, smaller amounts will have to be thrown away. All the teachers in a building must work together to insure that all groups have materials when they are needed and that equipment be available in good working order.

STOREROOM AND SUPPLIES

Every school has storage space for science equipment and supplies, and each school is adequately equipped with those supplies and equipment needed to carry on good instruction in science. Some system of responsibility must be worked out in each science department regarding maintenance of the storeroom and keeping the supplies and equipment in good order. The kind, quantity, and condition of equipment in each school reflect the initiative and general scientific attitude of the teachers in that building.

All science supplies in the building are for the use of any science teacher, regardless of the course taught. This policy has some modification, however, in the case of senior high school science courses, where each science has its own storeroom and supplies. Even here, there are times when a piece of physics equipment will lend itself well in supplying a need in the chemistry class or when some chemical is needed by the biology department. In these cases and other comparable ones, sharing is to be done.

It is imperative that science equipment be kept in good, clean condition and stored in an orderly way. When not in use, equipment should be cleaned and put into its proper place of storage in order to be ready for the next teacher who needs it. Science equipment is expensive, and all students should be taught respect for it. They should be instructed as to its proper use. Carelessness has no place in science, particularly in the laboratory.

In the use of materials, economy should be rigorously practiced. Avoid the mutilation of dissecting specimen. Certainly the teacher is expected to use sufficient quantities, and see that each student does the same. At the same time, wastefulness should be avoided. Many materials, after use, may be saved for later use. Mossy zinc, for example, after use should be washed and retained. Prevention of contamination is an important measure of economy. Students should not have access to the stock supply, but a portion of a chemical needed should be put into a separate, well-labeled container for student use.

Except in the case of supervised student assistants, no student should ever have access to the storeroom. This rule should be adhered to rigidly. Student assistants should be under the supervision of the teacher at all times. Never should the storeroom remain unlocked when the teacher is not present. All dangerous chemicals should be so stored that students never have access to them except under the most careful supervision.

All science departments are asked to make a thorough inventory of all equipment and supplies once a year. All shelves, containers, etc., should be cleaned at this time. All unusable containers and broken equipment should be discarded. Usable containers and shipping materials should be returned to the Science Supply Center, Central Warehouse.

USE OF LIBRARY AND SUPPLEMENTARY RESOURCES

Although each teacher should endeavor to have a supply of resource materials available in the classroom, the students should be encouraged to use the resources of the school library for further study. Learning how to seek out information in reference materials on what has been previously done and recorded is an important part of science instruction. This is a particularly valuable experience for students who are above average in their abilities.

One of the responsibilities of the science teacher is to assist the librarian in selecting new materials for the science section of the library and in training the students how to use the library effectively. The teacher should keep himself informed about the materials available in the library and should be alert for additional materials that could be added to the supply. A folder kept throughout the year for listing appropriate books and materials is a useful aid when the time arrives that the librarian asks for suggestions for making additions to the science section.

The teacher can make arrangements with the librarian for the class as a group to work for a full period in the library, or for sections of books to be reserved for a period of time, or for a number of books to be checked out and carried to the classroom for use, or for science book lists to be provided for reference purposes.

Topic Classification. Following is the science topic classification of the Dewey Decimal System which is used in the school libraries:

500	General Science	600	Technology
510	Mathematics	610	Medical Science
520	Astronomy	620	Engineering
530	Physics	630	Agriculture
540	Chemistry	640	Home Economics
550	Geology	650	Business
560	Paleontology	660	Chemical Technology
570	Biology	670	Manufactures
580	Botany	680	Other Manufactures
590	Zoology	690	Building Construction

Each student has a copy of *Your Library, A Guide for Students and Teachers*, a school district publication which is purchased in English classes. This publication supplies the student with full information about the use of the library.

Research Procedures: Following is an excerpt from page 47 of the new edition of *Your Library*:

Use of the Library in Research

Steps in Preparing a Research Paper

Step 1. Selecting and limiting the subject

Be sure that the subject is sufficiently narrow so that it can be covered adequately in the desired length of paper.

Step 2. Locating the possible sources of information

- a. The basic library tools:
 - The Card Catalog
 - Encyclopedias
 - Encyclopedia annuals and other year books
 - The Readers' Guide to Periodical Literature
 - The Information file (Vertical File)
- b. Specialized reference books
- c. Other books for information

Step 3. Skimming for information which bears on the subject

Step 4. Reading and taking notes that will aid in recall of essential information

Step 5. Outlining and writing the paper

Step 6. Compiling the bibliography

OUTLINE AND OUTLINING

An outline gives the main topics, or principal ideas, of a subject. It is a writer's blueprint, or plan, for an article, a theme, or a book. It may be used to summarize an article or a book for study, or to prepare a speech.

Formal outlines are of two kinds. The topic outline is a summary of topics and subtopics, or nouns and phrases, to indicate ideas. The sentence outline uses complete sentences for each division.

Organization: All topics of equal importance should be phrased in similar form and indented equally. The subject should be covered completely, but without too many main topics. Topic headings should be clear.

The topics and subtopics may be organized with Roman numerals (I), Capital letters (A), Arabic numerals (1), and small letters (a), in that order. Use periods after the number and letters. If more subdivision is needed, repeat the numbers and letters in parentheses. Do not use periods after the parentheses. Always use at least two subheads. Capitalize the first letter of the first word of each topic and subtopic. Use periods after sentences.

A Sample Topic Outline follows:

Outline on Floods

I. Definition of Floods

A. Extent of Floods

B. Effects of Floods

1. Bad effects

- a. Destroys property and homes
- b. Carries off topsoil
- c. Causes injuries and deaths

2. Good effects

- a. Creates fertile regions
- b. Transports soil
 - (1) Nile Valley
 - (2) Mississippi delta

II. Kinds of Floods

A. River Floods

1. Commonly overflowing rivers

- a. Mississippi - Missouri system
- b. Hwang Ho, or Yellow River

2. Causes

- a. Heavy rains
- b. Fast melting of snow and ice

TECHNIQUES IN TEACHING THE READING OF SCIENCE

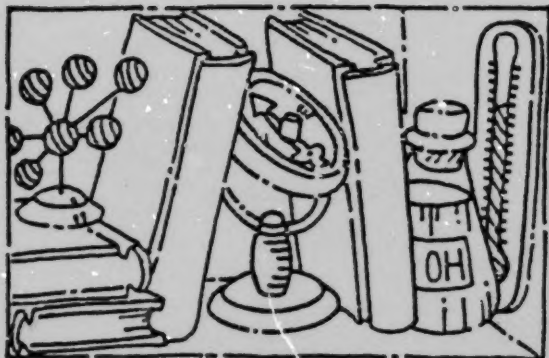
The following are some ways in which students may be helped to learn the reading skills for science while, at the same time, learning content. Some of the suggestions given for reading in other content subjects may be adapted to science:

1. Provide a section of the classroom where attractive pamphlets, magazines, and books can be displayed. Quantities of excellent materials can be obtained free or inexpensively from industrial firms and government agencies. The materials usually provide a wide range of subject matter as well as reading difficulty. The American Association for the Advancement of Science and the National Science Foundation both publish material of considerable value for teaching.
2. Underline, number or write down the steps in a process.
3. Try to write the findings of an experiment in one sentence.
4. In material where there are many facts, try to determine the most important ones by the aids given by the author. Some of these aids are: listing of important terms, use of italics, amount of space given to discussion of any one fact, pictures, or diagrams.
5. Have the students explain the practical use of what they have learned.

Some other activities include:

1. Encourage careful, thoughtful reading of scientific materials. Re-reading may be necessary. Rate of reading should be appropriate for doing exacting, analytical reading.
2. Help students read to follow directions, as when conducting a science experiment which involves a series of steps.
3. Help students learn the technical and special vocabularies of science.
4. Help students learn to read, to get meaning from, and to use equations, formulas, charts, schematic diagrams, abbreviations and symbols used in science.

5. Help students use the main ideas and details of science materials to derive generalizations and principles.
6. Help students learn to translate words into scientific symbols, formulas or equations.
7. Help students learn to translate science principles and relationships into appropriate formulas or equations.
8. Help students learn approaches to solving problems in science reading situations.



A NATURAL PARTNERSHIP FOR LEARNING

Development of students' reading skills in content areas, such as science, is one of the thrusts of the Right to Read effort in Texas.

Students aren't necessarily able to read science textbooks just because they can read basal readers, educators have found.

Science books are difficult for some to read because science has:

- a unique vocabulary to learn
- complex concepts to understand
- maps, graphs, charts, and calibrations on instruments to decipher

Furthermore, science books frequently are written at a level beyond the students' abilities both in reading and in science.

Many successful science teachers are accepting the responsibility of instructing students to read science materials. By enabling students to become better readers, science teachers can help them to become better science students.

SCIENCE: AN APPROPRIATE VEHICLE FOR DEVELOPING READING SKILLS

Science helps students learn:

- to observe
- to reason
- to think rationally
- to express themselves verbally

As students develop these skills, they will become better readers.

Students develop specific reading skills in the study of science because they are called on:

- to utilize word attack skills
- to develop comprehension
- to become self-directed in reading
- to learn to interpret what is read
- to read creatively

In hands-on science investigations students are motivated:

- to analyze what they read
- to use what they read
- to make judgements about what they read

Vocabulary

The language of science introduces to the student as many new words as does a foreign language. Students need help in learning:

- Words unique to science, such as
 - photosynthesis
 - friction
 - multicellular
 - fulcrum
- Common words that have a special meaning in science, such as
 - culture
 - normal
 - resistance
- Symbols and abbreviations used in science, such as
 - Ω
 - H_2O
 - $<$
 - $\rightleftharpoons$
- New words from science, such as
 - television
 - astronaut
 - sputnik
 - transistor

Comprehension Skills

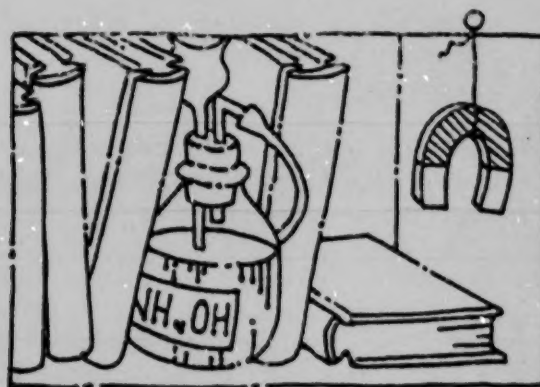
Science teachers can help students learn to:

- Recognize the main idea from graphs, charts, maps, and outlines
- Analyze information by
 - establishing a cause/effect relationship
 - synthesizing given "facts" into a viable idea
 - applying logic
- Formulate the central idea of a paragraph by
 - classifying, ordering, and sorting
 - observing similarities and differences

Speed

In science, students can develop the ability to adjust reading speed according to:

- Purpose
- Difficulty of material
- Complexity of concepts presented



AN EFFECTIVE METHOD OF READING SCIENCE MATERIALS

Teachers can further students' ability to read science materials by teaching them the following SQ3R* study skills formula:

1. Survey

Look over the science materials to be read.

Note:

- Title
- Headings
- Pictures, charts, graphs
- Special words

Give attention to:

- The first paragraph. Here the author usually gives the general scope of the topic covered.
- The last paragraph. This is the author's last chance to give "the message."

2. Question

Have a reason to read the materials. For each unit ask who?, what?, when?, where?, why?, and how?

3. Read

Answer the questions formulated. Read one section at a time.

Answer the questions on the section before going to the next section.

4. Recite

Recite aloud from memory the answers to the questions. Write them down.

5. Review

- Go over notes.
- Get the main idea.
- Recite the answer to all of the questions.
- Restudy the parts missed.

*Francis P. Robinson, *Effective Study: Revised Edition*, New York: Harper and Row, Publishers, 1961, pp. 13-14.

READING GRAPHS, CHARTS, MAPS, AND CALIBRATIONS

Special reading techniques are often required to understand the variety of sources which provides information for science students.

Graphs and Charts

Graphs and charts require reading from left to right and from bottom to top, top to bottom, and/or diagonally.

To read graphs and charts, students should:

- read the legend and interpret it in their own words
- note keys to the meanings of different colors, lines, and/or figures
- read labels at the bottom and left margins
- trace fluctuating lines and generalize on the kind of movement and what it means

Maps

The development of thinking skills used in problem solving is closely related to the development of the ability to read a map. In reading maps, students must:

- focus on what information is needed from the map
- observe the parts of the map that will provide the information needed
- analyze the information obtained from the map
- synthesize the information into a meaningful whole

Calibrations on Instruments

In reading calibrations, the students must ask:

- In what unit is the instrument calibrated? (Centimeters?, grams?, revolutions per minute?)
- Will the quantity measured be useful in providing appropriate information? (Centimeters will tell how long an item is, but not how heavy.)

By developing the special reading skills necessary for the study of science, students become better readers and better science students.

1978



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Austin, Texas 78701

LEARNING PARTNERS: READING AND SCIENCE

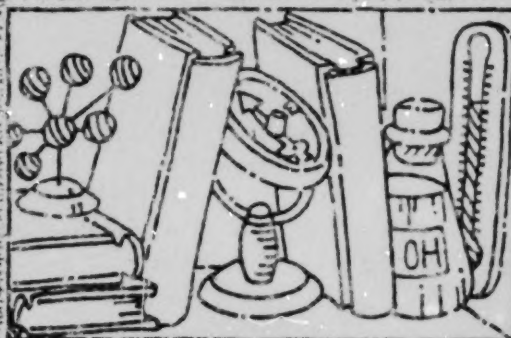
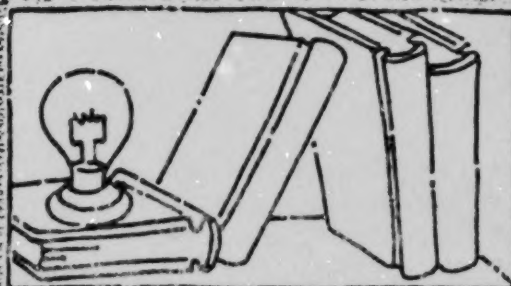


TABLE OF PREFIXES, SUFFIXES AND ROOTS
FREQUENTLY USED IN SCIENCE

A relatively small number of Greek roots and Latin roots are used in a large variety of ways in scientific vocabularies. A knowledge of these will enable one to translate most of the terms used in science subjects. A study of prefixes, suffixes and roots will help one to achieve an ability to derive meanings from context, which is important in both reading and understanding.

<u>Prefix, Suffix or Root</u>	<u>Meaning</u>	<u>Example</u>
a	negative, nor, without	asexual, amitosis
ad	to, toward	adductor, adrenal
alb	white	albino
amphi	both, double	amphibia
anthrop	human, man	anthropology
anti	against	antitoxin
aqua	water	aqueous
archo	ancient	archeology
auto	self	automatic, autobiography
bar	weight, heaviness	barometer
bi	two	binary
bios	life	biology
brachi	arm	brachiopod
centr	center	centrifuge
cephal	head	cephalorhorax
chlor	green	chlorophyll
chond	cartilage	chondriosome
chrom	color	chromatic
coel	hollow	coelom
cyst	pocket, capsule	statocyst

<u>Prefix, Suffix or Root</u>	<u>Meaning</u>	<u>Example</u>
cyt	cell	cytology
dem	people	demographic
dendr	tree	dendrite
derm	skin	ectoderm
di	two, second	dihybrid
ect	outer	ectoderm
ef	away, outward	efferent
end	inner	endoderm
enter	intestine	enteric
epi	upon, above	epidermis
eu	well, true	eutheria
ex	from, outer	excretion, exoskeleton
fer	bear, carry	porifera
gaster	stomach	gastric
gene	birth, descent	genalogy
ge	earth	geography
glossa	tongue	hypoglossal
graph	write	geography
haem	blood	hemoglobin, hematology
hetero	other, different	heterozygous
holo	entire, whole	holoblastic
homo	like, same	homology
hydr	water	hydrometer, hydrocephalic
hyper	over	hypertension
hypo	under, less	hyperdermic
iso	equal	isometric

<u>Prefix, Suffix or Root</u>	<u>Meaning</u>	<u>Example</u>
lamella	leaf or layer	lamellate
log (os)	study, discourse	biology, zoology
lun	moon	lunar
macro	large	macronucleus, macroscopic
maxilla	jan	maxilla, maxilliped
mer (os)	part, side	merozoite
meso	middle	mesoderm
meta	beyond, after	metazoa
meter	measure	thermometer
mito	thread	mitosis
morph	form	morphology
muta	change	mutation
myo	muscle	myofibril
nephro	kidney	nephridia
noto	dorsal	notochord
nym	name	pseudonym
oid	like	zooid
omni	all, total	omnivorous
ortho	straight	orthoptera
osteo	bone	osteomyelitis
para	near, beside	parathyroid
peri	around	pericardium
phag	eat	phagocyte
phil	attraction	eosinophil
phob	fear	claustrophobia
phon	sound	phonograph
phor	bear, carry	mastogophora

<u>Prefix, Suffix or Root</u>	<u>Meaning</u>	<u>Example</u>
photo	light	photosynthesis
phyt	plant	epiphyte
plasma	mold, form of life	protoplasm
pleur	side	pleuron
ped	leg, stem	milliped
pod	leg, appendage	arthropod
proto	first	protozoa
pseudo	false	pseudopod
pter	wing	diptera
sarc	flesh	sarcoplasm
scien	knowledge	omniscient
scler	hard	sclerite
soma	body	somatic
stom	mouth	stomata
syn (m)	together	synapse, symbiosis
taxis	arrangement	taxonomy
tel	far, distant	telescope, telephase
theca	sheath	spermatotheca
therm	heat	thermometer
throm	clot	thrombosis
tom	piece, section	anatomy
top	place	topography
tox	poison	toxic
trema	hole	trematod
troph	turn	toward
vagus	wandering	vagus nerve
zo (on)	animal	zoology
zyg	united, tied	zygote

Quantitative Prefixes

<u>Prefix</u>	<u>Meaning</u>	<u>Example of Use</u>
mon	one	monotone, monoxide
un	one	unicellular, unilateral
bi	two, twice, double	bicycle, bifurcate
di	two, twice, double	dimorphic
du	two, twice, double	duplex
ter	three	tertiary
tri	three	tripod, tritium
tetr	four	tetrachloride, tetrahedron
quadr	four	quadruped
a	without	abiotic
an	lacking	anarchy
heter	mixed	heterogeneous, heteromorph
hom	similar, throughout	monograft, homogenized milk
hyper	above, over, excessive	hyperesthesia, hypertoxic
hypo	less than, below, deficient	hypodermic, hypothyroid
is	equal, same	isomorphs, isothermal
micr	small	microscope, microbiology
poly	many, much	polychrome, polynuclear
tel	distant, far	telescope, television

From The Language of Science by Alan Mandell
National Science Teachers Assn., Publishers

HOW TO ORDER FROM THE OCEANOGRAPHY AND LIVING RESOURCES CENTER

Many living specimens may be ordered from the Oceanography and Living Resources Center. The order form has the instructions on how to order and lists of the live specimens available.

A few comments already on the requisition form are re-emphasized here:

1. Submit this requisition in duplicate directly to the Oceanography and Living Resources Center.
2. Be sure all blanks on the top of the requisition form have been completely and correctly filled in.
3. Be sure your order reaches the center on the Wednesday before you want the specimens on the next Tuesday. To do this, your order should be in the school mail on a Friday morning *before* the school mail is picked up. This is the latest you may mail your requisition.
4. Ordering five or six organisms on the same date does not promote effective use of the materials. You may send several orders in at one time, but space the dates they are to arrive at your school for more effective use.

In order to keep your specimens alive as long as possible, take samples of live specimens from the container and microscopically examine them. Follow the instructions from the Oceanography and Living Resources Center contained in this curriculum bulletin.

Requisition blanks can be obtained through the Secondary Science office, the Oceanography and Living Resources Center, or the Department Chairman of your school. When the Oceanography Center ships your order, they enclose two or more requisition forms and envelopes for your future use.

CARE OF SPECIMENS WHEN RECEIVED

Uncap the containers as soon as they arrive.

Store with the container caps ajar to prevent excessive dust accumulation but still provide ventilation.

Store in a cool place (approximately 70 degrees F.). In the cool fall or in winter, the classroom is suitable. During hot weather, store cultures in an air conditioned room. NEVER place in the refrigerator.

Drosophila become sterile above approximately 83 degrees F.

For all specimens except algae, store in the dark or in subdued light. Bottles could be placed in an open shoe box.

The algae should be in north window light or should have strong light for only a few hours each day. Overheating by intense illumination is disastrous. If bright sunlight falls on a closed container, it can elevate the internal temperature 10 to 20 degrees above the room temperature.

Examine the containers of *Hydra* for specimens that may have attached to the caps in shipping. (Both brown and green *Hydra* may be seen easily with the unaided eye.)

Taking Samples of Live Specimens from the Containers

Allow *Amoeba* cultures to be undisturbed for 30 minutes to settle to the bottom. Take samples from the bottom of the jar.

Use clean pipettes (eyedroppers) for each culture. Never allow students to use a pipette from one culture to another.

Shake a diatom container prior to taking samples for distribution to students as diatoms settle to bottom of their containers on standing.

Microscopic Examination of Live Specimens

Many invertebrate cultures can be seen easily with the unaided eye. When a new culture arrives, the first observation should be made by removing the container cap and attempting an unaided visual sighting. Prior to examination, remove the container lid and allow the culture to remain "quiet" or undisturbed for 20 to 30 minutes.

Afer a visual sighting is attempted, next use a low-power dissecting microscope. This is especially helpful for the small organisms such as *Vorticello* and *Amoeba*. Do not expect to see "streaming protoplasm" at these low powers, however. Always examine some of the debris or bottom trash. Many times stalked forms will attach there.

Some of the easily seen specimens are—

Daphnia—swimming freely in the fluid with a fast, jerky motion.

Hydra—attached usually to the bottom of the container. Will be contracted if the container was recently shaken. Recap and shake the container to dislodge.

Vinegar eels (*Turbetrix aceti*)—thin, hair-like, wiggling worms light in color, free swimming usually at top.

Eudorina, *Pandorina*, and *Volvox*—freely swimming, dark green colonies. Will be near surface in undisturbed cultures.

Blepharisma—usually on the bottom of an unshaken culture. They move slowly and give a pinkish color when viewed against a white background.

Paramecium (*caudatum* or *multimicronucleatum*)—freely swimming in the media and appear as silvery rods in strong light.

Stentor—free swimming, or attached to the bottom debris and side of container. View against a white background.

Vorticella—attached to container walls and on debris on the bottom of the unshaken container.

Spirotomum—long white ciliates that sometimes appear as white patches on the bottom of the unshaken container. View against a dark background.

Amoeba—often concentrated in the flocculent debris that is a water mold suitable for their ingestion. Allow cultures to be undisturbed for 30 minutes prior to examination. Use a dark background.

Diatoms—settle to the bottom of their containers on standing. It is advisable to shake a diatom container prior to taking samples for examination. High power (45X) objectives will prove most satisfactory for examination purposes.

Date of Requisition _____

LIVE SPECIMENS REQUISITIONSubmit this requisition in DUPLICATE DIRECTLY to: THE OCEANOGRAPHY & LIVING RESOURCES CENTER, Rt. 2

Deliver to: _____

School _____

Rt. # _____

Date of TUESDAY needed _____

Requested by _____

Coordinator or Chairman _____

Please indicate the number of classes to use the specimens by placing the number in the block;
i.e., for one class(1), for two classes(2), etc. (35 students per class)

LIVE SPECIMENS	No. of Classes	LIVE SPECIMENS	No. of Classes
Algae: blue-green, Nostoc		Protozoa: Amoeba proteus	
Oscillatoria		Blepharisma	
Algae, green, Chlamydomonas		Paramecium caudatum	
Chlorella		Paramecium multimicronucleatum	
Euglena		Pelomyxa (Chaos) (Demo. only)	
Desmids		Spirostomum	
Filamentous		Stentor	
Volvox		Coelenterata: Hydra	
Algae: yellow green, Diatoms		Platyhelminthes: Planaria	
Bacteria: Bacillus cereus, gram + rods		Nematoda: Turbatrix aceti	
Bacillus subtilis + rods		Trochelminthes: Rotifers	
Escherichia coli - rods		Mollusca: Freshwater snails	
Rhodospirillum rubrum - spirals		Arthropoda: Brine shrimp eggs	
Sarcina lutea + spheres		Daphnia	
Serratia marcescens - rods		Drosophila: Wild (normal)	
Fungi: Aspergillus glaucus		White eye-sex link Chr. I	
Penicillium notatum		Vestigial Chr. II	
Rhizopus stolonifer (+ and -)		Ebony Chr. III	
Fern: Leaflet with sori		Eyeless Chr. IV	
Prothalia		Mojavensis (Chr. squash)	
Flowering plants: Cuttings with hormone		Tenebrio	
Elodea cuttings		Mixed Pond microorganisms	
Rain lily bulbs		Pices: Goldfish (Nov. - April)	
Succulent leaves		Drosophila Instant Media (1 liter/class)	
Tradescantia		Nutrient Agar, Sterile Tubes	
Utricularia		Pond Water; send clean jug to OCEANOGRAPHY	

NOTE: Please allow 10 working days from the date the teacher prepares and mails requisition to the date of delivery.

Live Specimen List to be Ordered
from The Oceanography and Living Resources Center

- Chapter 3: Elodea
- Chapter 4: Paramecia
- Chapter 10: Bacillus cereus
Mixed pond microorganisms
Amoeba proteus
Paramecia
Euglena
- Chapter 11: Algae
- Chapter 12: Fern leaflet with sori
Prothalia
- Chapter 14: Flowering plants
- Chapter 15: Hydra
- Chapter 16: Planaria (demonstration supply)
- Chapter 17: Snails, brine shrimp, daphnia, tenebrio, drosophila
- Chapter 18: Tenebrio (mealworms)
- Chapter 28: Ferns, fungi, algae

MATERIALS

Textbook

The textbook adopted for seventh grade Life Science is Exploring Living Things, published by Laidlaw Brothers, a division of Doubleday & Company, Inc. The authors are Herbert A. Smith, Ralph P. Frazier, and Michael A. Magnoli. Teachers should also have the Teacher's Annotated Edition of the textbook "Activities for Exploring Living Things" with the teachers' annotated edition and the "Tests for Exploring Living Things."

Supplementary Aids

Films: A list of movies suggested for use will be added to each outline. The library of each school in the District has a Science Film Catalog for the teachers' use. It is suggested that before the film is used, it should be previewed and used only if it is appropriate to the subject being taught. The time length for each film is also listed for the teachers' aid.

Filmstrips and Transparencies: Each school has its own filmstrips and transparencies, which are kept in the library. Teachers can be of great help to the librarian by suggesting filmstrips and transparencies which they would like to have in their building. Each school librarian has an approved list of filmstrips and transparencies from which to make selections.

Charts: Each school has its own supply of science charts. Additional charts may be ordered through the HISD Warehouse Catalog which the chairman should have. If none is available, contact the Science Department at the Administration Building.

Models: Each school should have its own models. Additional models may be ordered through your building's equipment fund. The Museum of Medical Science has a lending or checking out system of their models.

Science Materials for the "Hands-On" Activities in Exploring Living Things

The following is a list of materials and equipment needed for students to complete the science activities suggested in Exploring Living Things. These activities, entitled Investigate, Do It Yourself, Doing More, and Investigate On Your Own, usually require little preparation and can be completed with easily obtained materials or simple laboratory equipment. The activities promote student involvement in exploring the concepts and processes of the biological sciences.

SUPPLIES AND EQUIPMENT NEEDED FOR EACH CHAPTER

UNIT 1 - BIOLOGY: The Study of Living Things

Chapter 1: How Living Things are Studied

Masking tape, paper towels, 2 glass panes about 10 x 10 cm, 10 radish seeds.....	12
Large living insect, ink, small bottle with one-hole stopper, petroleum jelly, 0.4% solution of potassium hydroxide, 2 ml pipette, 2 pipe cleaners.....	13
Aluminum foil, 2 petri dishes, 4 paper towels, 20 radish seeds.....	23

Chapter 2: What Does "Being Alive" Mean?

Microscope, salt solution, microscope slides, coverslips, amoebas, medicine droppers.....	32
Plant seeds, two pots.....	39

Chapter 3: Cells--Small Packages of Life

Microscope, medicine dropper, piece of onion, paper towel, iodine solution, 2 coverslips, 2 glass slides.....	43
Beaker, ink or food coloring.....	47
Cornstarch, 2 small test tubes, 2 pieces of animal membrane, 2 rubber bands, 2 small beakers.....	50
Prepared slides showing mitosis in cells.....	56
A carrot, strong salt solution.....	59

Chapter 4: Classifying Living Things

3 pots filled with soil, 3 jars, 3 labels, 5 kidney beans, 5 lima beans, 5 pole beans.....	71
Several small animals.....	76
Cardboard.....	91
Bag of lima beans or kidney beans.....	94
Drop of water containing paramecia, microscope, medicine dropper, dilute hydrochloric acid.....	94
Skeletons of several vertebrate animals.....	94

UNIT 2 - ECOLOGY: The Science of Survival

Chapter 5: Two Problems in Ecology

Three slices of bread, paper bag.....	107
Medicine dropper, test-tube holder, bromothymol blue solution, wax pencil, 4 test tubes, 4 corks...	111

Chapter 6: The Physical Environment

Freshly dug soil, microscope slide, magnifying glass or microscope.....	117
Plastic funnel, cardboard stand, small piece of steel wool, freshly dug soil, beaker of alcohol, light, very strong magnifying glass or microscope.....	120
Balance, sample of ocean water (or salt water), sample of river or pond water, sample of tap water, ring stand and ring, burner, asbestos pad, 3 beakers.....	124
Microscope, slide and cover glass, methylene blue stain, razor blade, (single edge), clover plant (freshly dug), medicine dropper.....	130

Chapter 7: The Biological Environment

Soil, seeds of wheat or rye, 3 wooden flats such as those used in greenhouses.....	147
Flannel board, yarn.....	155

Chapter 8: Some Natural Changes

2 plastic or paper cups of the same size, 2 aquariums or large dishpans.....	163
Large jar; leaves, twigs, and pebbles from a pond; glass plate; medicine dropper; microscope and slides.....	167

Chapter 9: Conservation and Natural Resources

Two rectangular wooden trays, soil, grass seed, sprinkling can.....	175
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UNIT 3 - PROTISTS AND PLANTS: Two Groups of Living Things

Chapter 10: Protists

Samples of water from a fish tank, a birdbath, and a pond; microscope.....	196
Hand lens, marker, small jar, 2 prepared nutrient-agar petri dishes, cotton swabs, samples of pond water or old aquarium water and soil.....	202
Microscope, microscope slide, coverslip, eyedropper, paramecia culture, carmine power.....	207
Burner, methylene-blue stain.....	211

Chapter 11: Algae, Fungi, and Lichens

Algae, microscope.....	215
Petri dish, bread, microscope-slide, coverslips, forceps, medicine dropper, water.....	222
Lichens, hand lens.....	224
Quart jar, sugar, baker's yeast, medicine dropper.....	227

Chapter 12: Mosses and Ferns

Sphagnum moss, hand lens, large beaker or jar.....	231
Microscope, microscope slide, coverslip, medicine dropper, paper towel, fern fronds with sori, water, glycerin.....	237
Glass, stalk of celery, red or blue food coloring, live twig, of a stem from a house plant.....	240
Coarse gravel, flowerpot, sand, a few ripe sori off a fern frond, a sheet of clear glass or plastic dish.....	243

Chapter 13: Gymnosperms

Conifer cones, oven.....	250
Small samples of wood and wood products.....	252
Burner, ring stand and ring, saucepan, wire, scissors, wire gauze, piece of fine wire screen, dried weeds...	256

Chapter 14: Flowering Plants

Glass jar, paper towel, soil, detergent, 2 half-pint milk cartons, seeds from a fresh, ripe tomato.....	267
Two or three different kinds of flowers.....	273
Four or five different kinds of seeds.....	283
Four small clay flowerpots, soil, oven, nitrogen- fixing bacteria, clover seeds.....	286
10 centimetre (about 4-inch) length from the stem of a coleus or geranium plant, flowerpot, wet sand, perlite, or vermiculite.....	286

UNIT 4 - ANIMALIA: The Eating Kingdom

Chapter 15: Sponges and Coelenterates

Modeling clay, bent paper clips or pins.....	293
Living hydras, magnifying glass, medicine dropper, slide, microscope.....	299
Pieces of different kinds of coral.....	303
Natural sponges.....	303

Chapter 16: Worms

Planarians, a petri dish, magnifying glass.....	306
String, several small pieces of meat, several jars.....	312
Earthworm, paper towel, toothpick, flashlight, soil in a container, alcohol.....	315
Map of the world.....	319
Earthworm, ice cubes, warm water.....	319

Chapter 17: Mollusks, Arthropods, and Echinoderms

Freshwater clam, knife.....	324
Grasshopper, magnifying glass.....	329
Garden snails, large glass container, moist soil, leaves, soft fruit.....	339
Glass jar, large glass jar or aquarium tank.....	339

Chapter 18: Fish, Amphibians, and Reptiles

2 or 3 small fish from a pond, stream, river, or lake; net, aquarium, water plants, air stone or filter.....	342
Frog eggs, pond water, water plants, rocks, insects, lettuce, aquarium pump.....	351
Turtle, snake, or lizard.....	355
Garter snake, terrarium.....	359

Chapter 19: Birds and Mammals

Binoculars, field guide of birds.....	366
Mouse, bottle large enough for the mouse to fit inside one-hole stopper to fit the bottle, glass tubing rubber tubing, wooden supports, 20 grams of potassium hydroxide.....	368
Large map of the world.....	379
Scales from several different large fish, magnifying glass.....	382
Snail eggs, microscope.....	382
Cocoons or chrysalises or insects.....	382

UNIT 5 - THE HUMAN BODY: A Study of Yourself

Chapter 20: Protection, Support and Movement

Large pan, burner, cloth strip, electric fan, 2 tall glasses, 4 thermometers.....	390
Razor blades, microscope and slides, various types of bones.....	396
Prepared slides showing the three different kinds of muscle.....	403

Chapter 21: Digestion and Excretion

Calorie-counting booklet.....	410
Sugar solution, cornstarch, graduated cylinder, hot plate, test-tube holder, test-tube rack, Benedict's solution, 2 beakers, 3 test tubes.....	412
10 grams of pepsin, 500 millilitres of a 1 percent hydrochloric acid solution, different kinds of food...	419

Chapter 22: Respiration and Circulation

Watch with a second hand.....	422
Large bottle, stopper, pan of water, rubber or plastic tube.....	424
Microscope, microscope slides, cover glass, needle, methyl alcohol, Wright's stain, beaker or small jar...	431
Large bottle with the bottom cut off or a bell jar with a neck, one-hole stopper, glass tube, thin rubber balloon, piece of rubber sheet.....	435
Fever thermometer.....	435

Chapter 23: Control and Regulation

Small pieces of apple, carrot, onion, potato, etc.....	448
Fine-pointed marking pen, stiff brush, metal probe, ice water in container, needle.....	449
Medicine dropper, sugar solution, lemon juice, salt water, and dissolved aspirin.....	455

Chapter 24: Reproduction and Development

Clusters of snail eggs, clear glass bowl or petri dish, hand lens or binocular microscope.....	464
Cow's eye or sheep's eye, single-edged razor blade and tweezers.....	478
Stethoscope.....	478
Thyroid extract, tadpoles.....	478

UNIT 6 - LIFE: Its Beginnings and Changes

Chapter 25: How Life May Have Begun

Alcohol burner, wooden splint, cotton, bread, meat, paper, salt, sugar, test-tube holder, heat-resistant test tubes.....	487
Meat tenderizer, water, hot plate, frying pan, pot holder, knife and fork, small piece of chuck steak, plate.....	492

Chapter 26: Heredity and Change

PTC paper, mirror, hand lens, paper, pencil.....	505
Colored paper, plain paper, scissors, pencil.....	510

Chapter 27: Changes and Development

Large, colorful scene of the countryside in spring, large scene in color of the countryside in fall, cardboard, the same color magazine paper having tones of green and red.....	526
Hand lens, forceps, 4 different kinds of flowers with leaves.....	530

Chapter 28: Searching into the Past

Modeling clay, seashell, Vaseline, plaster of paris, water.....	546
Half-dollar, water sand, clay, gravel, 3 aluminum pie pans.....	550

SUPPLIES AND EQUIPMENT LISTED IN ALPHABETICAL ORDER

The materials needed to conduct the activities in this manual are listed below in alphabetical order to provide a reference for the teacher. The number or numbers following each item of material indicate the activity or activities in which the material is needed. In some instances the name of a material is preceded by an asterisk. The asterisk is used to indicate that the material is perishable and should be obtained or prepared near the time the activity is to be carried out.

This list may be useful to the teacher (1) in requisitioning supplies, (2) in finding a specific description of how an item of material is to be used, and (3) in determining quantities of material needed for a specific activity.

A

Acetic acid solution (vinegar): 35
Agar: 16, 17
Alcohol: 18
Aluminum foil: 1
Ammonia, household: 24
* Ant, wingless queen: 25
* Ant, worker: 25
Ant farm: 25
* Ant larvae: 25
Ant nest, earth from: 25
* Ant pupae: 25
Antibiotic disks (penicillin, neomycin, Chloromycetin, streptomycin, Terramycin, Aureomycin, tetracycline, erythromycin): 16
Antiseptic samples (mouthwash, iodine, alcohol, Merthiolate, Mercurochrome): 17
Aquarium: 28, 29
Aquarium pump and filter: 28, 29
Aquarium shelter: 28

B

Bag, small plastic: 9, 20
Balance, triple-beam and/or two-platform: 9
Beakers, assorted sizes: 5, 6, 6, 9, 14, 18, 31, 33
Bean, dried: 1
* Beef, raw: 26
Benedict's solution: 32

Bird book: 43
Bird chart: 43
Bird picture: 43
* Bone, chicken leg: 44
* Bone, chicken wing: 44
* Broth culture of Bacillus cereus: 16, 17
Brush, small: 23
Burner: 14, 15, 18, 32

C

Calcium chloride: 3
Capillary tubing: 7
Cardboard: 3, 5, 6, 35
Cardboard box or incubator: 16, 17
Cheesecloth: 26
Clamp, burette: 7, 14, 15
Coal, soft: 15
Coat hanger, wire: 12
Coffee cans with clear lids: 3
Copper sulfate, crystals: 19
Cornstarch: 31
Cotton: 3
Cotton swab: 16, 17, 24, 36
Coverslip: 2, 4, 13, 20
Crucible tongs: 18
Cups, clear plastic: 22
Cups, paper: 41
Cups, polystyrene: 38

D

Debris, from ditch or pond: 13
 Detergent: 19
 Dialysis tubing: 7
 Digger, dandelion: 11
 Distilled water: 13, 14, 19,
 27, 32

E

* Earthworm: 24
 * Egg, chicken: 5
 * Eggs, brine shrimp: 27

F

Fertilizer: 19
 Filter paper: 17
 Fish food: 28
 Flashlight: 24
 Flask, Erlenmeyer: 33
 Flask, Florence: 14
 Forceps: 16, 17, 20, 29, 37
 * Frog: 29
 * Fruit: 26

G

Glass square: 13
 Glass tubing: 14, 15
 Goldfish: 28
 Graduated cylinder: 1, 5, 6, 9,
 19, 31, 33

H

Hammer: 9, 12
 Hand lens: 20, 23, 27
 Honey: 25
 Hot plate: 9

I

* Ice: 14
 Index card: 42, 45
 Iodine solution: 18, 31
 * Isopod: 3

J

Jar, large: 19, 26
 Jar, quart, widemouthed: 13, 41

K

Knife: 6

L

* Lichen: 20
 Light source: 3, 28
 Lugol's solution: 32

M

* Mammal such as gerbil, hamster,
 white rat, or white mouse: 30
 Matches: 18
 Maze: 30
 * Mealworm: 29
 Medicine dropper: 2, 4, 13, 20, 23
 31, 33, 35
 Methylene blue solution: 4
 Metre stick: 1, 10, 12, 41
 Metric ruler: 9, 11, 16, 17, 32,
 37, 40
 Microscope: 2, 4, 13, 20
 Microscope slide: 2, 4, 13, 20, 23
 Mortar and pestle: 9, 31
 * Mosquito: 26

N

Newspaper, small piece: 2, 35

O

Orange juice: 31
 Organisms, numbered examples from
 the three kingdoms: 8

P

Pan: 18, 24, 29
 Paper, colored: 41
 Paper punch: 41
 Paper towel: 4, 21, 24, 36

Pencil, glass-marking: 7, 13,
14, 16, 17, 19, 22, 23, 27,
32, 40

Petri dish: 16, 17, 21

Phenolphthalein solution: 33

* Planarian: 23

* Plant, Coleus (variegated): 18

* Plant, Elodea: 4

Plastic, sheet of clear: 35

Pliers: 12

* Pond water: 13, 19, 23, 26

Popsicle stick: 5, 6

* Potato: 6

Potato peeler (apple corer): 6

Probe or dissecting needle: 24

Q

Quinine solution: 36

R

Razor blade, single-edged: 23

Reference materials on a system
of classification: 8

Refrigerator or ice chest: 21, 27

Ring stand and ring: 7, 14, 15,
18, 32

Rock: 3

Rubber stopper: 33

Rubber stopper, one-holed: 14, 15

Rubber tubing: 14

S

Salt, table (sodium chloride): 5,
6, 14, 27, 36

Scalpel: 22, 27

Scissors: 5, 21

Seed, Bean: 21, 22, 40

Seed, corn, albino: 38

Seed, radish: 21

Silver nitrate solution: 14

Soda straw: 33

Sodium hydroxide solution: 33

Spoon or trowel: 9

* Starch suspension: 32

Stirring rod (glass): 9, 31, 33

String, ball of: 7, 9, 11, 12, 29,
41

Sugar solution: 36

Syrup, dark: 7

T

Teaspoon: 19

Test paper, pH: 9

Test tube: 14, 27, 31, 32

Test tube, Pyrex: 15

* Testing materials for vitamin
C (lemon juice, lime juice,
grapefruit juice, green pep-
per, wheat-germ oil, Hi-C
drink, Kool-Aid drink, milk,
vitamin C tablet): 31

Test-tube holder: 32

Test-tube rack: 14, 27, 31, 32

Thermometer: 9, 21, 27, 32

Thread, black: 2

Thread, white: 2

Toothpick, flat: 4

Tweezers: 5

V

Vermiculite: 22, 38

Vinegar (acetic acid solution);
24, 36

W

Watch (with second hand): 30,
33, 41, 42

Watch glass: 23

Water plant: 28

Wire gauze: 14, 15, 18, 32

Wood splint: 15

Wooden stake: 9, 12, 41

RESOURCE MATERIALS

ADDICTIVES: Alcohol, Tobacco, and Drugs

Following is a list of materials for use in the addictives unit. Copies are available for review from the department chairman at each school. If a classroom set is desired for the room, please order at least six weeks prior to the time for the unit to allow for mail delivery.

BEST TIME TO STOP DRUG ABUSE IS BEFORE IT STARTS, THE...

This 11 x 14 inch full-color poster pictures two young boys on a set of steps talking. It stresses the fact that "you" can make the difference in preventing drug abuse. Also included at the bottom of the poster is an address to write for additional material. A limit of 25 copies is available in the United States, Canada, and Australia

National Clearinghouse for Drug Abuse Information
P.O. Box 1080, Rockville, Maryland 20013

NAME OF THE GAME IS, THE...

This 17 x 22 inch poster features the game of "drug abuse prevention." Any number can play is the point which is stressed. Although it is not really a game, the board is similar to a monopoly game with "chance" and "community chest" becoming "decisions" and "choices." A limit of 25 copies of this poster is available in the United States, Canada and Australia.

National Clearinghouse for Drug Abuse Information
P.O. Box 1080, Rockville, Maryland 20013

ALCOHOL ABUSE AND WOMEN: A GUIDE TO GETTING HELP...

There is no single cause of alcoholism for either women or men. One's psychological makeup, environment, and physical factors probably all interact to contribute to the development of an alcohol problem. Professionals in the field agree, however, that most of the alcoholic people they work with suffer an unusual amount of stress and deprivation in their lives. The fact that women suffer from alcohol abuse is a fact that has only recently been discovered. This booklet is a guide to women who do, or think they do, abuse alcohol. It gives tips to help them overcome this type of abuse. Single copies are available world-wide.

National Clearinghouse for Alcohol Information
P.O. Box 2345, Rockville, Maryland 20852

ALCOHOLIC AMERICAN, THE...

This publication provides basic information on alcoholism and alcohol abuse. It points out that today's typical alcoholic is not the "skid row" type, but rather a middle class, middle management executive. The booklet approaches the excessive use of alcohol as the major part of the total drug abuse problem; 40 pages with four-color graphics. Single copies are available in the United States, Canada and Australia.

Blue Shield Association
Contact local Blue Cross & Shield Agency

ALL IN THE FAMILY: UNDERSTANDING HOW WE TEACH AND INFLUENCE CHILDREN ABOUT ALCOHOL...

All in the Family is a program to help people become more conscious and aware of the important role that they can play in the prevention or minimization of alcohol problems within the context of family life or personal development. This guide is concerned with the presentation of facts and information. It is not intended implicitly or explicitly to encourage or discourage drinking. Single copies for aid in using this book are available.

National Clearinghouse for Alcohol Information
P.O. Box 2345, Rockville, Maryland 20852

DRUGS VS. CANCER, DHEW PUBLICATION 76 (NIH) 75-786...

This report contains information on the present status of cancer chemotherapy. It contains a discussion of the intensive effort that is being made by the National Cancer Institute, the drug industry, universities, medical centers, and private research organizations to develop new drugs for treating cancer. A list of the anticancer drugs now in use is included. Single copies or classroom quantities are available to members of the professional staff who make requests on official stationery. Available world-wide.

National Cancer Institute
Office of Cancer Communications
Bethesda, Maryland 20014

TEACHING ABOUT DRINKING...

Why should teachers be involved? Because alcohol education is or soon will be part of the school curriculum. Teachers can do a great deal to educate young people to recognize and understand the major influences on students' attitudes and to be critically self-guiding about alcohol. This

brochure suggests various attitudes and approaches to the problems of teaching about drinking. Single copies are available world-wide.

National Clearinghouse for Alcohol Information
P.O. Box 2345, Rockville, Maryland 20852

WARNING TO PARENTS: AMPHETAMINE...

A new and insidious drug habit has spread among teenagers. They use amphetamines which are stimulants chemically related to adrenalin, a substance produced within our bodies. This report is written in the belief that if youth are regularly warned of the danger in these "harmless" pills, if adults are aroused to demand forceful, consistent action by educators, police, and other authorities, the problem can be controlled within a limited time. Although this booklet is addressed to parents, it should prove useful to teachers as well. Single copies are available free; however, this source would appreciate receiving postage reimbursement. Classroom quantities are available for a fee. Available in the United States.

Narcotic Educational Foundation of America
5055 Sunset Boulevard, Los Angeles, California 90027

YOU AND YOUR HEALTH...

This booklet features articles on drug abuse, venereal disease, heart disease, physical fitness, mental health, alcoholism, sex education, accidental poisoning, the elderly, learning disabilities, medicines and the family, and nutrition. While the reading is too difficult for children, it presents the facts in a concise manner for adults. It offers solutions to the problems as well as presenting the problem. Limit of 10 copies free; additional copies are available for 10¢ each. Available world-wide.

Council on Family Health
Department ETG, 633 Third Avenue
New York, New York 10017

For the packet of material as was used at the Drug and Crime Prevention Seminar which is required for certification by the Texas Education Agency, write to the address below for free material:

Department of Community Affairs
Box 13166, Capitol Station
Austin, Texas 78711

Additional pamphlets and brochures may be obtained by contacting the Science Instructional Specialist in your area for further lists and addresses.

UNIT 1

INTRODUCTION TO LIFE SCIENCE

Time Allotment
20 days for entire unit

Chapter 1: How Living Things Are Studied

Advanced Preparations:

1. Get classroom supply of pond water or aquarium water.
2. Have students prepare flats of available seeds for two weeks' observation for experiment on pp. 23, 147.
3. Order Amoebas for experiment on p.32.

Major Concepts to be taught:

The development of scientific investigation
The development of the fields of biological science
The development of the processes of investigation
(Scientific Method)
Recognition and use of scientific tools
Measurement in the metric system

Instructional Objectives:

The student should be able to -
Explain the ways in which to investigate living things,
Spell and recognize the meaning of biology, zoology,
botany, ecology, physiology, and taxonomy.
List and recognize the processes of the scientific method.
List scientific problems applicable to current times.
Construct an experiment to test a hypothesis.
Define, identify, spell and use basic scientific tools.
Measure, using metric units.

Assessment:

The student will:

- List scientific investigations that are of interest.
- Write one sentence each on biology, zoology, botany, taxonomy, ecology, and physiology.
- Give the steps of the scientific method in finding solutions.
- *Identify on sight and spell correctly: microscope, litmus paper, beaker, test tube, petri dish, balance scale, meter stick, graduated cylinders, thermometer, glass slide, and cover glass.

- *Identify a base or an acid from several solutions using litmus paper.
- Label and list the major parts of the microscope.
- E*Focus a microscope, using 10X and 43X objectives.
- E*Determine the mass of an object to the nearest .1 gram using a balance.
- E*Determine the length of an object to the nearest .1 centimeter using a metric ruler.
- E*Determine the volume of a liquid to the nearest milliliter using a graduated cylinder.
- E*Determine the temperature of the air to the nearest degree Celsius using a thermometer.
- Given the formula, convert °F to °C and °C to °F.

Materials:

Textbook: Exploring Living Things, pp.10-27
 Reference: Teacher's Overview, pp. T11-12

Laboratory Experiments:

- Do plant roots grow toward water? p.12
- How much oxygen does a small animal use? p.13
- How is an experiment set up and performed so that a control is used? p.23
- Activity No. 1: A Metric System for Measuring, pp.1-4, Activity Booklet
- Activity No. 2: Using a Microscope, pp.5-10, Activity Booklet

Films:

- L5311 - Louis Pasteur: Man of Science, 26 minutes
- M5677 - Country Vet, 12 minutes
- M8000 - Exploring with Your Microscope, 20 minutes
- M5487 - Making the Unseen Visible, Lesson 502, 20 minutes
- M7891 - Science: New Frontiers, No Easy Answers, 14 minutes
- M6804 - View from the People Wall: A Statement About, 14 minutes
- M6480 - Metric Measurement I: Measurement and Why We Need A Standard Unit, 14 minutes
- M6481 - Metric Measurement II: What is the Metric System and How It Is Used, 15 minutes

Suggested Activities:

- Find Out More, p.18
- Do It Yourself, p.18
- Find Out More, p.24
- Checking Up: Vocabulary, p.26
- Knowledge and Understanding, p.26
- Concepts, p.27
- Application and Critical Thinking, p.27
- Doing More, Questions 1 and 2, p.27

Investigate On Your Own, Question 1, p. 94

In Guide:

Scientific Method: Bill Has a Problem
Laboratory Information
Pictures of Laboratory Equipment
The Laboratory Balance
Thermometers
Graduated Cylinder Activity
Litmus Lab - Blue Is For Base
Measurement - System International
Metric Information
Drawing: One Section of the Meter Stick
Student Worksheet on the Nifty Metric Ruler
Metric System Worksheet I
Metric System Worksheet II
Science 7 - Lab Activity Measurement
Metric Measurement Outdoors
Suggested Parts of Microscope to Point Out to Students
Suggested Procedures to Point Out When Instructing Students
in Use of Microscopes
Microscope Parts Identification
Microscope Lab: Using the Letter "e"

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES														
The student will -- Explain the ways in which to investigate living things. Spell and recognize the meaning of <u>biology</u>, <u>zoology</u>, <u>botany</u>, <u>ecology</u>, <u>physiology</u>, and <u>taxonomy</u>.	Have the students read pp.11-14 and discuss starred questions and questions in margins. Before study of the scientific method, place students into groups to design a plan to investigate something of the living world that arouses their curiosity. Divide the class into two groups. Have one group do the experiment on p.12 and the other do the experiment on p.13. Have each group give a five minute report on the results. *Students may set up different activities for investigation, such as aquariums, terrariums, ant colonies, insect collections, earthworm houses, rodent cages, and indoor plants. Do It Yourself: Visit a Biologist, p.18. Invite a guest speaker from the community: a doctor, veterinarian, pharmacist, health careers person, etc. *Students may make a chart of large circles and have each represent a career in science, then cut out people or tools to represent each career. Assign library reports on biology careers: (1) prepare a paragraph; (2) make one-minute oral presentations. <table> <tr> <td>anesthesiologist</td><td>embryologist</td></tr> <tr> <td>biologist</td><td>entomologist</td></tr> <tr> <td>exobiologist</td><td>ichthyologist</td></tr> <tr> <td>dentist</td><td>medical illustrator</td></tr> <tr> <td>dermatologist</td><td>medical secretary</td></tr> <tr> <td>dietitian</td><td>medical technologist</td></tr> <tr> <td>ecologist</td><td></td></tr> </table>	anesthesiologist	embryologist	biologist	entomologist	exobiologist	ichthyologist	dentist	medical illustrator	dermatologist	medical secretary	dietitian	medical technologist	ecologist	
anesthesiologist	embryologist														
biologist	entomologist														
exobiologist	ichthyologist														
dentist	medical illustrator														
dermatologist	medical secretary														
dietitian	medical technologist														
ecologist															

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	microbiologist nurse ornithologist paleontologist pathologist pediatrician podiatrist veterinarian Assignments can be made on the basis of the student's interest and ability. @Have students do an in-depth research into a field of interest. Doing More, No. 1, p.27.
List and recognize the processes of the scientific method.	Observation Game: Divide the class into groups. Each group chooses the most observant member, who stands in the hall while objects are rearranged in the classroom. (Example: turn one desk around, write something on the board upside down, lower the shades, etc.) Chosen students have three minutes to make their observations. The group with the longest list wins. Have the students collect advertisements from newspapers and magazines, then prepare a report showing whether or not the materials contain unfounded beliefs or facts. Have students look up the steps of the "scientific method" in various reference books and report their findings to the class. Mystery Box: Place a variety of "mystery items (glass rod, rubber eraser, paper clips, etc.) in a shoe box, cover and have students make observations and hypothesize on the type of objects inside the box: (number, type of materials, possible objects.) Scientific Method Activity Sheet: Bill Has a Problem (Sheet is included in guide.)

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Investigate: How is an experiment set up and performed so that a control is used? p.23. Begin students on science projects.
List scientific problems applicable to current times.	Use a classroom situation and have students present a problem, decide what materials will be needed, get a hypothesis stated from other information available, try different ways to solve it (trial and error), make observations, and finally draw a conclusion (Example: teaching a pet a trick, making a dress, building a model plane, etc.) Have the students use newspapers or magazines to find current events related to scientific problems.
Construct an experiment to test a hypothesis.	Discuss Careers, Testing a Hypothesis, p.25. Assign a student activity whereby an individual problem is solved, using the scientific method. (These can be related to school, home, or community.) For example: "Do I work better when I eat breakfast?" "Do I study better when the radio is off?" "How can I work and go to school at the same time?" (Student should learn to state problem and chart daily observations.)
Identify, spell, and use basic scientific tools.	Distribute copies of "Tools for Scientific Use" to students to keep as reference.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Distribute "Microscope Parts Identification" and use as a classroom exercise. The sheet may also be used as a test. *Teacher-made materials involving mix-n-match games, word identification games, and picture recognition. *Lab Practical to identify equipment; answers can be written or oral. Have a spelling bee or have students write out vocabulary words: <u>investigate</u>, <u>hypothesis</u>, <u>theory</u>, <u>experiment</u>, <u>observe</u>, <u>control</u> and <u>variable</u>. Litmus Lab: Blue is for Base (Sheet is included in guide.) Use common household liquids such as lemon juice, baking soda solution, milk, cola, milk of magnesia, ammonia, orange juice, water, dishwashing detergent, saliva, etc. Microscope Lab: Using the letter "e" (Sheet included in guide.) Activity No. 2: Using a Microscope, pp.5-10, Activity Booklet.
Measure, using metric units.	This area may be saved and emphasized in any chapter in which metric measurement is used. Suggested Student Activities: *Drawing of one section of the metric stick. (Sheet included in guide.) *Student Worksheet on the Nifty Metric Ruler. (Sheet included in guide.) *Graduated Cylinder Activity. (Sheet included in guide.)

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -	*Use Celsius thermometers to measure the temperature of various areas of the room (air above desk, air from blowing fan, aquarium water, hot water, cold water.) Have students make a chart of the temperatures and draw the Celsius thermometer, labeling (1) boiling and freezing points of water (2) the different temperatures from the chart using a color code. Activity No. 1: A Metric System for Measuring, pp.1-4, Activity Booklet. Investigate on Your Own, Question No. 1. p.94. Collect labels from different containers that have metric units (milk cartons, soda pop, canned goods, etc.) and make a display. Use the formula for temperature conversions: $^{\circ}\text{F} = \frac{9}{5} ^{\circ}\text{C} + 32$ $^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32)$ Note: Use boiling point of water on both scales to check out formulas. Additional metric information, activities and labs are included in the guide. Metric measurement should be stressed whenever applicable in the course of study. These activities can be delayed until a particular activity or lab necessitates the use of a metric instrument.

SCIENTIFIC METHOD

Bill Has A Problem

The following paragraph involves scientific processes for solving a problem.

- I. Sentences or groups of sentences are numbered. Using the key below determine the process of each numbered sentence(s).

Key:

- A. Make observation and identify problem.
- B. State hypothesis.
- C. Collect data.
- D. Accept or reject hypothesis.
- E. Form conclusion.

1) Bill walked into his garage and found that the front tire on his bicycle was flat. 2) He also noticed that there was some broken glass lying around the bike. 3) His first thought was that the flat tire was due to the broken glass. However, he decided to investigate further. 4) Bill then took the tire off the bike and started to check it over, and soon found a nail embedded in the tread of the tire. 5) He found no other holes or slits. 6) Bill determined that the broken glass was not responsible. 7) The flat tire, Bill decided, was due to the nail.

For each sentence number, circle the correct letter using the key above.

- | | |
|-------------------|-------------------|
| 1. A. B. C. D. E. | 6. A. B. C. D. E. |
| 2. A. B. C. D. E. | 7. A. B. C. D. E. |
| 3. A. B. C. D. E. | |
| 4. A. B. C. D. E. | |
| 5. A. B. C. D. E. | |

II. Questions:

- 1. Are there any other ways that Bill could have used to check to see what caused the tire to become flat?
- 2. If you had seen the flat tire first, would you have hypothesized that the glass caused the flat tire?
- 3. What step do you think was most important in Bill's search for the reason for the flat tire? Explain.

LABORATORY INFORMATION

Laboratory Safety Precautions for Students

Touch or handle equipment only after instructions are given.

Keep lab tables clear of books, purses, microscope covers, etc., while doing investigations.

Stay in your assigned area during lab.

Use gas jets only for lab experiments with Bunsen burner.

Know where the fire extinguisher is located in the lab room. Never attempt to blow out a fire or pour water on a chemical fire.

Be careful when using scissors, forceps, and other sharp objects.

When indicated by the lab teacher, GOGGLES are to be worn.

Report any accident - cuts, burns, breakage of glass, etc. immediately to the teacher.

When working with microscopic specimens, wash hands thoroughly with soap and water at the end of the lab session.

Enter the preparation room only with permission from the teacher.

Care of the Lab and Equipment by Students

Pick up after yourselves! Throw paper trash in the waste can before leaving the lab room. Clean sinks and water cabinets.

The brown paper towels are used for drying hands. The sponges are for wiping table tops and sink tops.

Leaving the lab tables with clean equipment, chairs pushed in, and expendables replaced.

It is important that science equipment be kept in good, clean condition and stored in an orderly way.

IN LAB: LISTEN, LOOK, LEARN

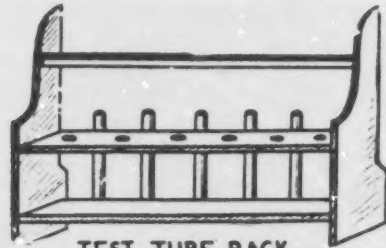
PICTURES OF LABORATORY EQUIPMENT



TEST TUBE



TEST TUBE HOLDER



TEST TUBE RACK



BEAKER



FLORENCE FLASK



ERLENMEYER FLASK



FUNNEL



RETORT



EVAPORATING DISH



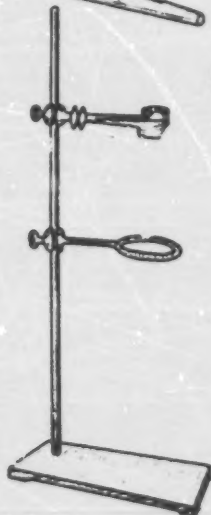
MORTAR AND PESTLE



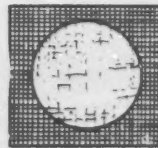
CRUCIBLE



GRADUATE



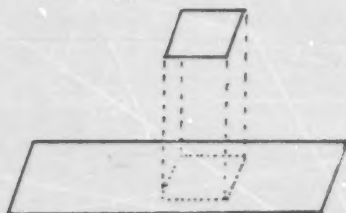
RINGSTAND WITH CLAMP AND RING



WIRE GAUZE WITH
ASBESTOS PAD



PIPE STEM
TRIANGLE



COVER SLIP

SLIDE



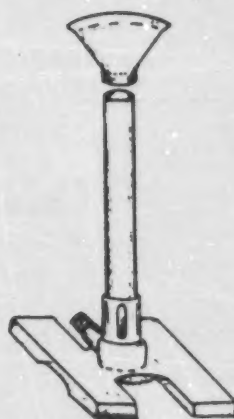
PETRI DISH



DEFLAGRATING SPOON



THISTLE TUBE



BUNSEN BURNER WITH WING TOP



FORCEPS



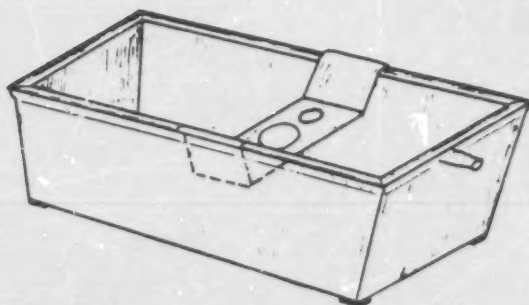
TONGS



WATCH GLASS



REAGENT BOTTLE



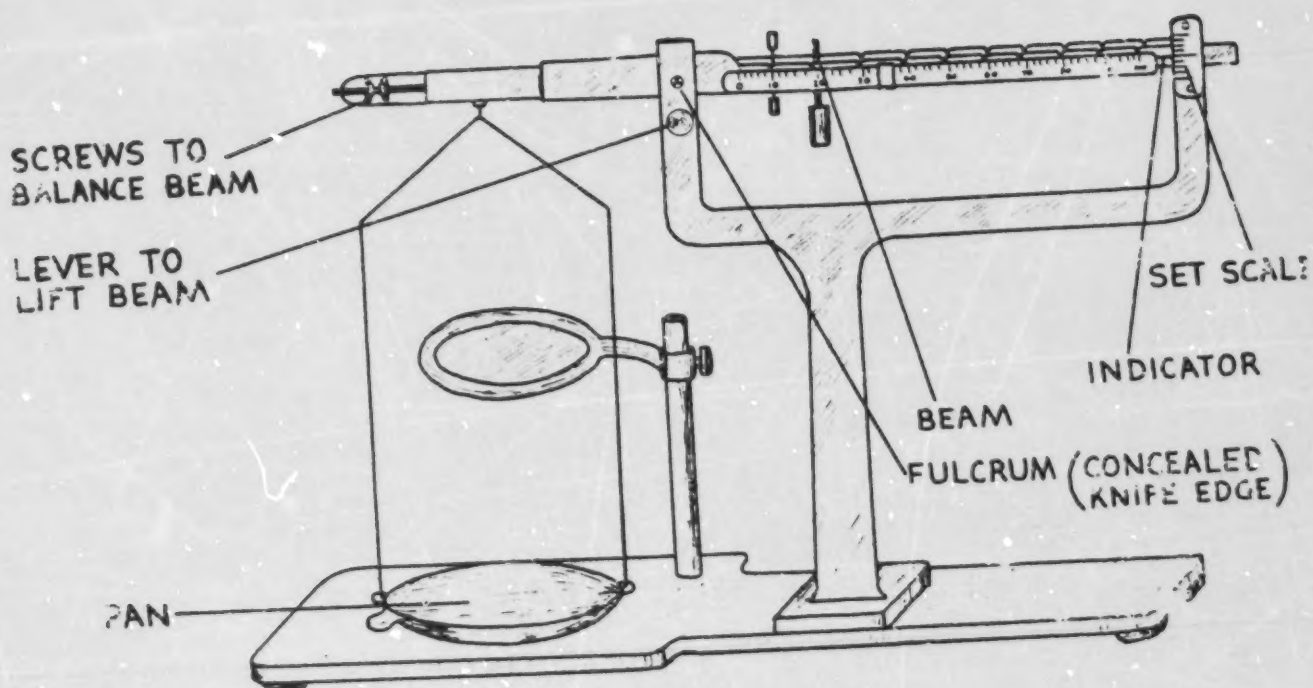
PNEUMATIC TROUGH



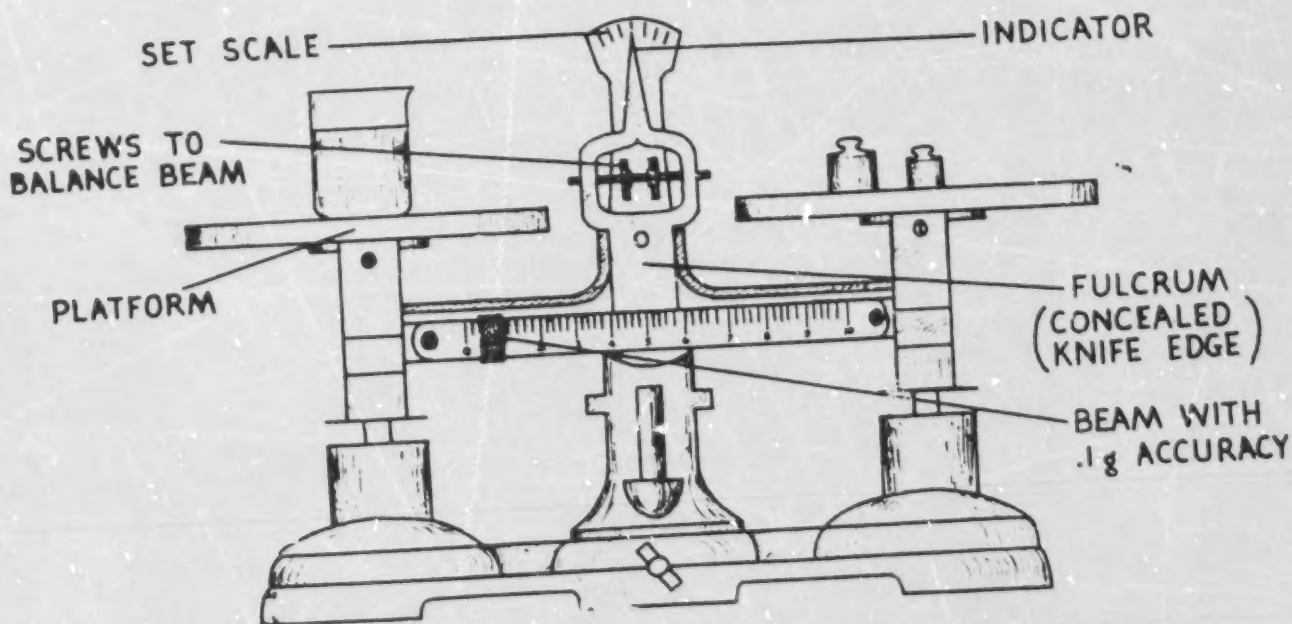
BLOWPIPE



COLLECTING BOTTLE



TRIPLE BEAM BALANCE



PLATFORM BALANCE

THE LABORATORY BALANCE

Exact measurements are an important part of any science. Measurements of weight are of vital importance in chemistry. A chemical balance or scale has its accuracy built into it, but that accuracy can be seriously affected by the use and care that the balance receives.

Your instructor will designate some special place where weighings are to be made. *Never take your balance to your laboratory desk*; it is possible that it may come in contact there with caustic chemicals or water and thus start a corroding process which will destroy the accuracy of the balance. Avoid interchanging the parts of balances. *If you are to make several consecutive measurements, use the same balance each time.* Do not place hot objects upon the balance pan and never place any chemicals directly upon the pan. Return the balance to the scale cabinet when you finish working with it.

Examine your laboratory balance, noting the diagram. It will be either a triple beam or platform balance; the scientific principles of each are identical. An object to be weighed rests on a pan or platform and is to be balanced by weights on the opposite side of a fulcrum, or balance point. With the triple beam balance, weights are moved out along the bar from the zero point and into the position where the beam will be balanced. With the platform balance, small weights are placed on the platform until the beam is balanced.

Find the knife edge upon which the beam rests. If your balance has a beam release mechanism, locate the lever or screw which lifts the knife edge of the beam off the agate bearing. The balance should *never* be moved with the beam resting on the agate, and it is best to have the beam lifted whenever the balance is not in use.

Put all the weights at zero and see whether the beam is balanced. The center of the indicator on the beam should stop at the middle of the set scale or swing approximately equal distances on each side of the center. If it does not do so, ask your instructor to show you how to balance the beam.

To weigh an object, put that object on the left side of the balance; use a piece of paper or beaker as the container for chemicals. Add weight to the right side of the beam by moving the 10-gram weight out along the bar until that side of the beam dips, indicating that the weight on the left side has been exceeded. Move the weight back one notch and repeat the process on the 1 and .01 gram sections of the beam. The procedure would be the same with the platform balance, except that weights are taken from a box and placed on the right platform. These weights should be picked up with forceps, not with your hand. Add weights until a 10-gram weight causes the platform to dip. After removing the last 10-gram weight, use the slide on the single beam to complete the balance. The beam will be balanced when the weights plus the slide exactly match the weight of the object on the left side; the indicator on the beam will be at the center of the scale.

To read the weight when using the triple beam balance, take the sum of the weights on each bar of the beam. The .01 gram weight should be read on its left side. With the platform balance, take the total of the weights on the right platform plus the reading on the slide. Remember to subtract the weight of the container which held the chemical.

Use the lever to lift the beam off the knife edge. Remove the weighed object and return the weights to the zero position or to their storage box. Dust off any particles of chemicals, paper, etc., and return the balance to its cabinet.

THERMOMETERS

Name _____

Period _____

Introduction to Thermometers:

Thermometers are used to measure temperature. They are marked (calibrated) with a scale. There is a different scale for each of the thermometers above. One is the scale in Fahrenheit degrees; the other is the scale in Celsius (or Centigrade) degrees.

In a Fahrenheit scale, each mark (division) is two degrees (2°). For example, 3 marks above 20° is 26° . In a Celsius scale each mark is only one degree, and three marks above 20° is 23° . Because we need accurate measurements this is very important.

How to Read Thermometers:

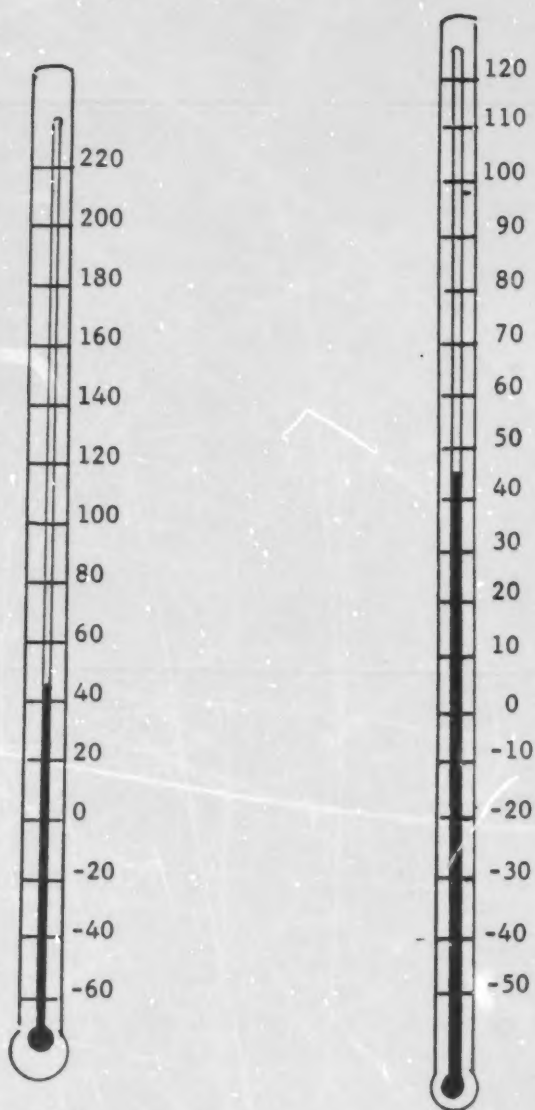
Fahrenheit

1. Find the point to be read. (Ex: arrow)
2. Read the first number below that point. (Ex: 40)
3. Count the number of marks from this number to the point to be read. (Ex: 3)
4. For each mark counted, add two degrees to the number below the mark. (Ex: $40^{\circ} + 3 \text{ marks} = 40^{\circ} + 6^{\circ} = 46^{\circ}$)
5. This is the temperature.

Celsius

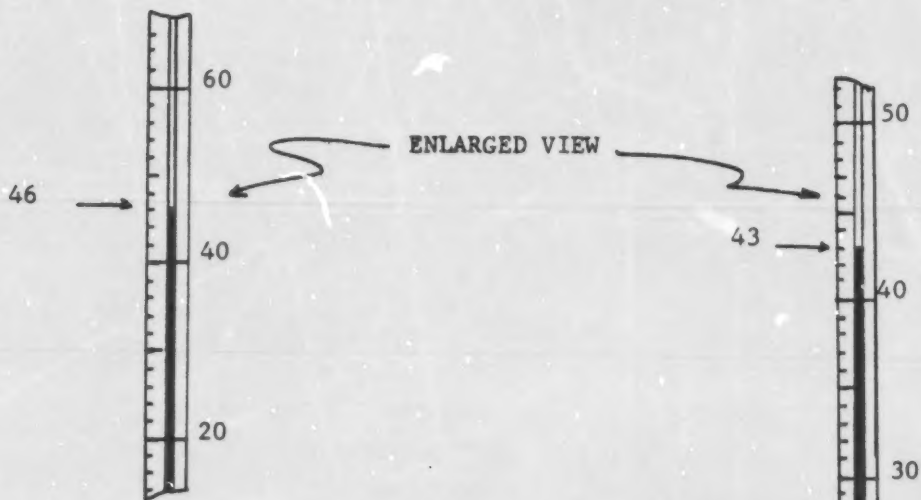
1. Find the point to be read. (Ex: arrow)
2. Read the first number below that point. (Ex: 40)
3. Count the number of marks from this number to the point to be read. (Ex: 3)
4. For each mark counted, add one degree to the number below the mark. (Ex: $40^{\circ} + 3 \text{ marks} = 40^{\circ} + 3^{\circ} = 43^{\circ}$)
5. This is the temperature.

THERMOMETERS



Fahrenheit

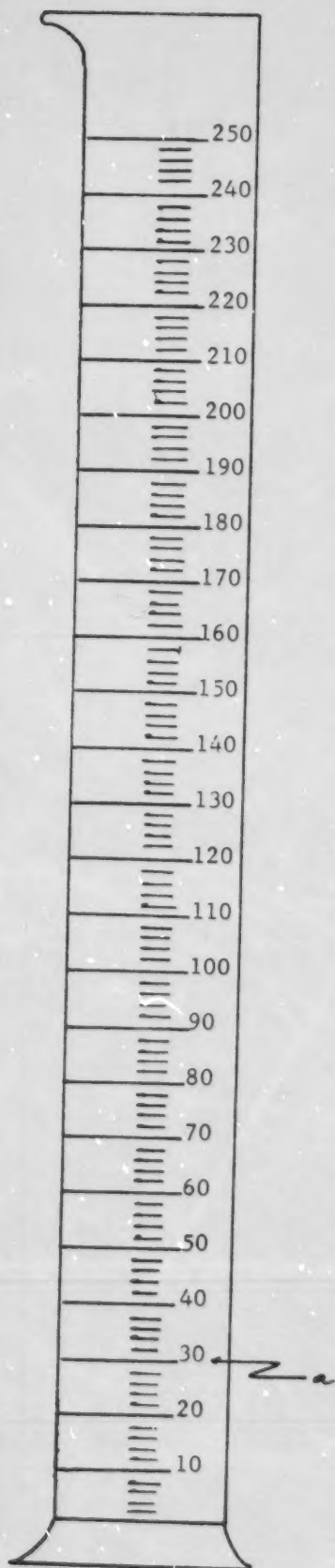
Celsius



Fahrenheit

Celsius

GRADUATED CYLINDER ACTIVITY



1. Locate on the graduated cylinder at the left the following measures, and label them. (The first one is done for you.)

- a) 30 ml
- b) 230 ml
- c) 157 ml
- d) 119 ml
- e) 92 ml
- f) 24 ml
- g) 189 ml
- h) 114 ml
- i) 53 ml
- j) 225 ml
- k) 31 ml

One liter equals 1,000 cubic centimeters; therefore one milliliter is equal to one cubic centimeter.

2. Calculate the volume of the above measures, using the information about milliliters and centimeters to find it.

LITMUS LAB -- BLUE IS FOR BASE

Scientists need ways to tell one thing from another. Sometimes just looking is good enough, but most of the time it isn't. It is often very hard to tell what differences exist. One difference that is easy to determine is the acid base difference. Some substances form an acidic solution when they are dissolved in water. Other substances form a basic solution. You can tell the differences using litmus paper. (Litmus paper is paper containing the dye litmus. Red litmus paper turns blue in basic solution. Blue litmus paper turns red in an acidic solution. If the blue and red litmus papers do not change color, than the solution is called a neutral solution.

Problem: To determine whether or not the liquids listed in Table A are acids, bases, or neutral.

Procedure: Add a small amount of each liquid given for you to list in Table A to properly labeled beakers or test tubes.
Add a very small piece of red litmus paper and blue litmus paper to each liquid.
Observe any color changes that occur to the litmus paper. Record your results in the Observation column of Table A. Write, "no change," or "turned blue," or "turned red."

*HINT: SEEING THE COLOR CHANGE THAT OCCURS WHEN LITMUS PAPER IS ADDED TO DIFFERENT SUBSTANCES WILL ALLOW YOU TO DECIDE WHETHER THE SUBSTANCE IS ACID, BASE, OR NEUTRAL.

Conclusion: Indicate in Column B whether each liquid was an acid, base or neutral.

TABLE A

TABLE B

LIQUID TESTED	OBSERVATION		CONCLUSION
	Red Litmus	Blue Litmus	
1. Water			
2. Baking Soda Solution			
3. Hydrochloric Acid Solution			
4. Vinegar			
5. Table Salt Solution			
6. "Household Ammonia"			
7. Lemon Juice			
8. Milk of Magnesia Solution			
9. Sugar Solution			
10. Calcium Hydroxide Solution			

Answer these statements:

1. What is litmus paper?
2. What does it come from?
3. If blue litmus paper turns red, the substance is an _____.
4. If red litmus turns blue, the substance is a _____.
5. If there is no change with either one, the substance is _____.
6. What instrument is used to indicate the strength of acids and bases? _____
7. If the number is below 7, the substance is _____.
If the number is above 7, the substance is _____.
8. Why was it necessary to test water before you tested any of the solutions?

MEASUREMENT System International

In this system of measurement, the unit of length is the meter, the unit of capacity or volume is the liter, and the unit of mass (often incorrectly called weight) is the gram.

In this decimal system of measurement, all sub-units vary by ten.

1000 units	100 units	10 units	Basic Units	.1 unit	.01 unit	.001 unit
kilo	(hecto)	(deka)	grams meter liter (dollar)	(deci)	centi	milli

The same prefixes are used with all the units. The prefixes in parenthesis are rarely used; you need to know that a sub-unit is there.

To change from one unit to another, move the decimal the number of spaces in the direction indicated by moving from the given sub-unit to the desired sub-unit in the chart above.

Examples: Change 15.72 dollars to cents.

Move the decimal two places to the right to get 1572 cents.

Change 456.7 kg to cg.

Move the decimal 5 places to the right to get 45,670,000 cg.

Change 667 ml to liters (l).

Move the decimal 3 places to the left to get .667 liters.

Some examples of sizes expressed in metric units are:

One meter is slightly longer than one yard.

A popsickle stick is one centimeter wide and slightly longer than one decimeter.

A standard paper clip is about one centimeter wide and the wire has a diameter of one millimeter.

A football field plus one end zone is about 100 meters.

Many students are familiar with two and three-meter diving boards.

A nickel has a mass of 5 grams and a paper clip about one gram.

A pound of butter has a mass of 454 grams.

A teaspoon of water has a mass of 5 grams.

A teaspoon will have a volume of 5 milliliters and a cup a volume of 240 milliliters.

A quart has a volume slightly larger than one liter.

For a student to calculate his own mass in grams, he would multiply his weight in pounds by 454 grams per pound. How would he change this mass to kilograms? Why are masses of people normally expressed in kilograms?

To find his height in centimeters, the student would multiply his height in inches by 2.54 centimeters per inch.

METRIC MEASUREMENT

Basic Units

Unit of Mass: Gram
Unit of Length: Meter
Unit of Volume: Liter

Decreasing- Increasing Metric Prefixes

<u>Prefix</u>	<u>Multiple of Basic Unit</u>
Kilo	1000
Hecto	100
Deka	10
Basic Unit	1
Deci	.1
Centi	.01
Milli	.001

THE METRIC SYSTEM

The metric system of measurement is used by scientists all over the world and is used by everyone in many countries of the world.

I. Standard Metric units of measurement:

<u>Measurement</u>	<u>Unit</u>	<u>Symbol</u>
length	meter	m
volume	liter	l
mass (weight)	gram	g

II. Prefixes commonly used for larger or smaller units of measurement:

<u>Prefix</u>	<u>Common fraction</u>	<u>Decimal fraction</u>	<u>Symbol</u>
kilo	1,000 units	1,000 units	k
deci	$\frac{1}{10}$ unit	.1 unit	d
centi	$\frac{1}{100}$ unit	.01 unit	c
milli	$\frac{1}{1000}$ unit	.001 unit	m

III. Metric Unit of Length:

Basic unit: Meter

One kilometer equals 1,000 meters. (1 km = 1,000 m)

One meter equals .001 kilometer. (1 m = $\frac{1}{1000}$ km)

One decimeter equals .1 meter. (1 dm = $\frac{1}{10}$ m)

One meter equals 10 decimeters. (1 m = 10 dm)

One centimeter equals .01 meter. (1 cm = $\frac{1}{100}$ m)

One meter equals 100 centimeters. (1 m = 100 cm)

One millimeter equals .001 meter. (1 mm = $\frac{1}{1000}$ m)

One meter equals 1,000 millimeters. (1 m = 1000 mm)

IV. Metric Unit of Volume:

Basic unit: Liter

One milliliter equals .001 liter. (1 ml = $\frac{1}{1000}$ l)

One liter equals 1,000 milliliters. (1 l = 1000 ml)

V. Metric Unit of Mass:

Basic Unit: Gram

One kilogram equals 1,000 grams. ($1 \text{ kg} = 1000 \text{ g}$)

One gram equals .001 kilogram. ($1 \text{ g} = \frac{1}{1000} \text{ kg}$)

One centigram equals .01 gram. ($1 \text{ cg} = \frac{1}{100} \text{ g}$)

One gram equals 100 centigrams. ($1 \text{ g} = 100 \text{ cg}$)

One milligram equals .001 gram. ($1 \text{ mg} = \frac{1}{1000} \text{ g}$)

One gram equals 1,000 milligrams. ($1 \text{ g} = 1000 \text{ mg}$)

VI. Metric-English Equivalents:

Approximate:

A popsicle stick is just about one centimeter wide and one decimeter or ten centimeters long.

One quart is just about the same as one liter; one cup is just about the same as 250 milliliters.

The nickel coin has a mass very close to five grams.

Exact

one inch (in)	= 2.54 centimeters (cm)
one liter (l)	= 1.06 quarts (qt)
one meter (m)	= 39.37 inches (in)
one mile	= 1.61 kilometers (km)
one kilogram (kg)	= 2.2 pounds (lb)
one pound (lb)	= 454 grams (g)

VII. Factors of Measurement:

All measurements include two factors, a number and a unit of measurement. Omission of either factor from an expression of measurement causes that expression to be meaningless. When recording data or answers to problems, always remember to include the number and the unit of measurement.

METRIC SYSTEM

Prefixes	Whole Numbers			Unit Name	Decimal Fractions		
	kilo	hecto	deka		deci	centi	milli
	\$1,000	\$100	\$10	Dollar	\$0.10 1 dime	\$0.01 1 cent	\$0.001 1 mil
	km 1000 m	hm 100 m	dam 10 m	Meter (m)	dm 0.1 m	cm 0.01 m	mm 0.001 m
	kl 1000 l	hl 100 l	dal 10 l	Liter (l)	dl 0.1 l	cl 0.01 l	ml 0.001 l
	kg 1000 g	hg 100 g	dag 10 g	Gram (g)	dg 0.1 g	cg 0.01 g	mg 0.001 g

METRIC INFORMATION

Le Systeme International d' Unites (the International System of Units) has agreed to the following points for use of the metric system. (The SI you often run across as you read about the metric system refers to the International System of Units.)

1. Metre and litre are the favored spellings, rather than meter and liter.
2. In pronouncing the units, accent the prefix.
3. The symbols for tera, giga, and meta are capital letters. All other symbols are lower case letters.
4. The prefix and unit name are all one word: kilometer.
5. Use no period after the symbol unless it is the end of the sentence.
6. All symbols should use the singular form: 15 metres = 15 m (not 15 ms).
7. SI unit names are capitalized only at the beginning of sentences.
8. Separate the numerical value from the symbol by a space: 15 mm (not 15mm).
9. Use a space, (not a comma) to separate large numbers into groups of three: 1 234 769 (not 1,234,769).
10. Use decimal notations for the expression of partial units with zero before the decimal. Do not use fractions: 0.75 km (not 3/4 km).
11. A prefix should not be used alone: kilogram (not kilo).
12. The use of m^2 and m^3 is better than square metres and cubic metres.
13. "Mass" is preferred over "weight." Weight is a force and requires force units. Grams and kilograms measure "mass" while newtons measure "force." Use "What is the mass?" rather than "What is the weight?" if grams or kilograms are the units involved.
14. Record metric measurements as a single unit: 1.41 m or 141 cm (not 1 metre and 41 centimetres).
15. Capital "C" is the symbol for Celsius.
16. The symbol for "per" is a slash "/", as 30 km/h.

DRAWING: ONE SECTION OF THE METER STICK

BACKGROUND: The Metric System has the advantage of units based on tens and multiples of 10. For example, there are 10 millimeters in one centimeter; 10 centimeters in one decimeter; 10 decimeters in one meter; 100 centimeters in one meter; 1000 millimeters in one meter.

THUS, the Metric System is a decimal system.

ONE DECIMETER (dm)



- PROCEDURE:
1. Label your drawing, "One Section of a Meter Stick."
 2. Make a drawing of a part (section) of a meter stick, as shown above. Enlarge this smaller drawing, shown above, to a full page size drawing.
 3. Use the following color code to color each part:
 - (a) Millimeter: Blue
 - (b) Centimeter: Red
 - (c) Decimeter: Green
 4. Label each part you have drawn. Be sure to use the correct symbol and color.
 5. Draw a heavy black arrow along the bottom of your drawing to indicate the amount of length equivalent to one inch. (Hint: Remember you have enlarged the section of the meter stick that you have drawn.)

DON'T FORGET TO TITLE YOUR PAPER AND PUT YOUR NAME AND PERIOD NUMBER ON THE PAPER TO IDENTIFY IT. BE NEAT.

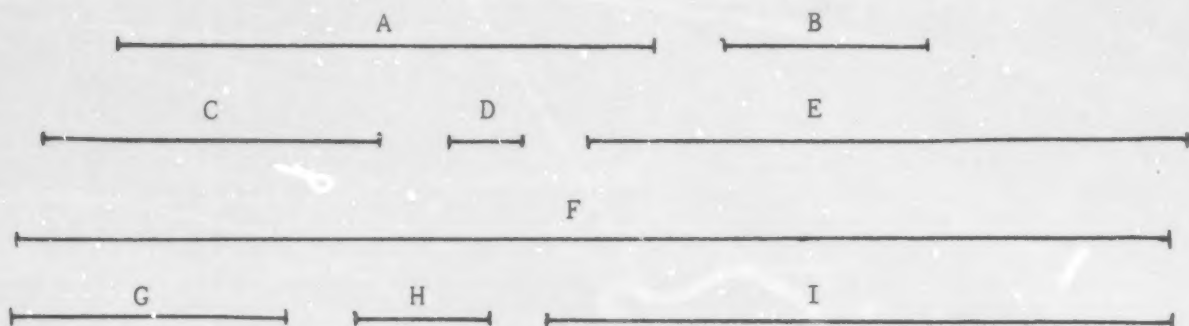
STUDENT WORKSHEET ON THE NIFTY METRIC RULER

THE WORKSHEET REQUIRES THE USE OF A STUDENT-SIZE 12-INCH METRIC ENGLISH RULER

Your Metric-English ruler has 2 SETS OF NUMERALS. The 1 to 12 set measures in INCHES (in), and the 1 to 30 set measures in CENTI-METERS (cm). Notice that each cm contains 10 MILLIMETERS (mm).

SOME THINGS TO DO WITH YOUR METRIC RULER:

1. Measure the LENGTH of this page to the nearest cm. _____ cm
2. Measure the WIDTH of this page to the nearest cm. _____ cm
3. Measure each of the following line segments to the nearest cm



- | | | |
|--------------|--------------|--------------|
| (a) _____ cm | (b) _____ cm | (c) _____ cm |
| (d) _____ cm | (e) _____ cm | (f) _____ cm |
| (g) _____ cm | (h) _____ cm | (i) _____ cm |

4. Now measure each of the line segments in (3) above in mm.

- | | | |
|--------------|--------------|--------------|
| (a) _____ mm | (b) _____ mm | (c) _____ mm |
| (d) _____ mm | (e) _____ mm | (f) _____ mm |
| (g) _____ mm | (h) _____ mm | (i) _____ mm |

METRIC SYSTEM WORKSHEET I

Use your information sheet as a guide.

I. Fill in the chart

	Metric	English system
Length	_____	_____
Volume	_____	_____
Weight	_____	_____

II. Drill

A. Meters

- $\frac{1}{1000}$ of a meter = _____ millimeters
1 meter = _____
- $\frac{1}{100}$ of a meter = _____ centimeters
1 meter = _____
- $\frac{1}{10}$ of a meter = _____ decimeters
1 meter = _____
- 1 kilometer = _____ meter
1 meter = _____ kilometers

B. Liters

- $\frac{1}{1000}$ of a liter = _____ milliliters
1 liter = _____
- 1 kiloliter = _____ liters
1 liter = _____ kiloliters

C. Grams

- $\frac{1}{1000}$ of a gram = _____ milligrams
1 gram = _____
- $\frac{1}{100}$ of a gram = _____ centigrams
1 gram = _____
- $\frac{1}{10}$ of a gram = _____ decigram
1 gram = _____
- 1 kilogram = _____ grams
1 gram = _____ kilogram

METRIC SYSTEM WORKSHEET II

Use your information sheet as a guide.

I. What unit of measurement in the metric system would you use to determine the following?

1. The size of a room? _____
2. The amount of juice in a glass? _____
3. The distance traveled from here to Conroe? _____
4. The amount of gasoline your parents' car uses per mile? _____
5. The weight of a package of hamburger? _____

II. A. Write the fraction and decimal value for each of the following prefixes.

		<u>fraction</u>	<u>decimal</u>
1. milli	=	_____	_____
2. centi	=	_____	_____
3. deci	=	_____	_____

B. What is the value of the prefix kilo? _____

III. Write out what each symbol represents (Ex: dg - decigram)

1. m = _____
2. g = _____
3. cm = _____
4. mg = _____
5. km = _____
6. l = _____
7. ml = _____
8. kg = _____
9. mm = _____
10. dm = _____

IV. Work the following problems. List the types of measurement involved. (Ex: volume, distance, or mass)

measurement

- | | | |
|--------------------|----|-------|
| 1. 4 km = _____ | m | _____ |
| 2. 600 cm = _____ | m | _____ |
| 3. 5 g = _____ | cg | _____ |
| 4. 2000 mm = _____ | m | _____ |
| 5. 5 kg = _____ | g | _____ |
| 6. 3 m = _____ | cm | _____ |
| 7. 3000 mg = _____ | cg | _____ |

III. Complete the following table. Write the words and abbreviation

Prefix	Unit Names	Length	Volume	Weight
		meter		
	milli (<u>1</u>) 1000	millimeter (mm)		
	centi (<u>1</u>) 100			
	deci (<u>1</u>) 10			
	kilo 1000			

IV. Work the following problems:

1. 2 kilometers = _____ meters
2. 1 centimeter = _____ meters
3. 1 milligram = _____ grams
4. 2000 milliliters = _____ liters
5. 1 gram = _____ milligrams
6. 4,000 millimeters = _____ meters
7. 32 liters = _____ milliliters
8. 2,000 mg = _____ grams
9. 2 l = _____ ml
10. 5,000 ml = _____ l

SCIENCE 7-LAB ACTIVITY MEASUREMENT

Work in groups.

Each student make a copy.

I. Goggle Box

A. Find the dimensions of the box in centimeters

1. Length _____ cm
2. Width _____ cm
3. Height _____ cm

B. Compute the volume of the box

1. Volume= _____ cm
2. Volume of water in ml it will hold is _____ ml

II. Dimensions of Text Book

A. In Centimeters

1. Length _____ cm
2. Width _____ cm
3. Height _____ cm

B. In Millimeters

1. Length _____ mm
2. Width _____ mm
3. Height _____ mm

C. Volume of water in ml it would hold if it were a prism. Volume= _____ ml

III. Thickness of a Single Sheet of Notebook Paper (Devise a method of doing this)

A. Thickness is approximately _____.

B. Mass of a single sheet of notebook paper is _____

IV. Volume of Water Baby Food Jars Will Hold (at room temperature)

A. Large Jars
_____ ml

B. Small Jars
_____ ml

V. Temperature Measurement

A. Room Temperature

F= _____

C= _____

B. Wet Temperature

F= _____

C= _____

Put a *wet* paper towel around the bulb and hold in front of fan until the temperature becomes constant. (remains the same)

METRIC MEASUREMENT OUTDOORS

STRATEGY:

You will perform all measurements in metric units.

You will make necessary calculations to convert metric units to English units.

MATERIALS:

Meter sticks

Pencil and paper

PROCEDURE:

Measure the length and width of a brick in the building, a parking space, football field, tennis court, gymnasium, car, and school campus.

Return to class and perform necessary calculations in order to complete chart.

Item measured		meters	kilometers	centimeters	millimeters	inches	feet	miles
Brick	(length)							
	(width)							
Parking space	(length)							
	(width)							
Football field	(length)							
	(width)							
Tennis court	(length)							
	(width)							
Gym	(length)							
	(width)							
Car	(length)							
	(width)							
Campus	(length)							
	(width)							

SUGGESTED PARTS OF MICROSCOPE TO POINT OUT TO STUDENTS

(Add or delete according to the microscopes being used)

Locate these parts on your microscope and also label them on the drawing.

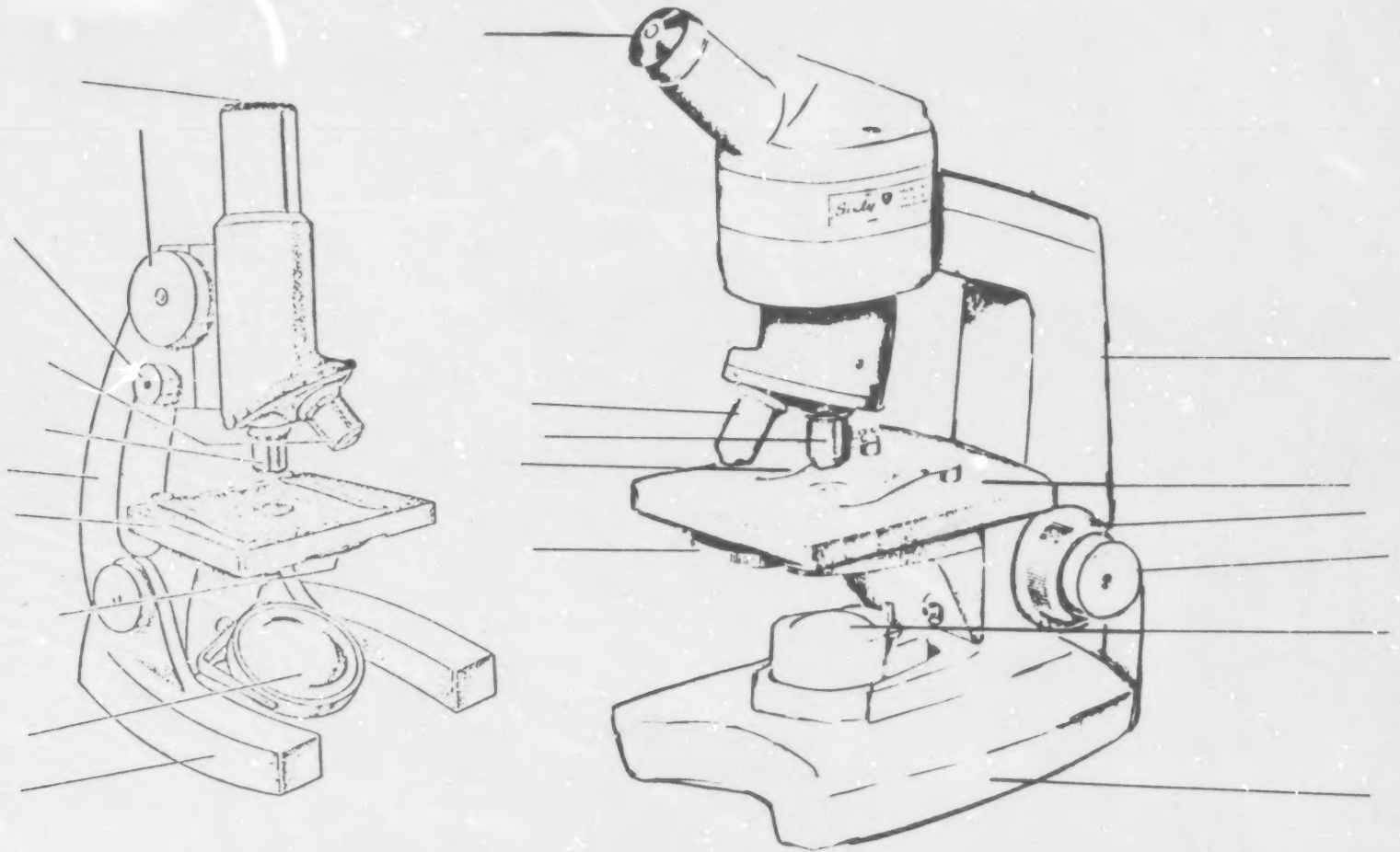
- a. The base is the heavy supporting structure on which the microscope rests.
- b. The mirror is usually curved inward on one side and flat on the other. It can be turned in any direction to direct light through the system of lenses in the microscope. Some microscopes use a lamp, called an illuminator to furnish light.
- c. The stage is the flat platform on which slides may be placed for observation.
- d. The iris diaphragm is a circle of sliding "leaves" just below the stage. It can be opened and closed to control the amount of light entering the microscope. Some microscopes have a rotating disc which has different sized holes and which can be moved to regulate the amount of light.
- e. The (body tube or barrel) is the hollow tube through which the light travels from the mirror or lamp, through the slide, objective to the eye piece.
- f. The objectives are the lenses on the body tube just above stage. The one marked with the largest number is high-power and the one with the smallest number is low-power. Most student microscopes have 2 or 3 objectives, usually 10X and 43X or 4X, 10X, and 43X. (This number with the "X" indicates the magnifying power of the lens system.)
- g. The revolving nosepiece is the fitting to which the objectives are attached and can be rotated so that any objective may be in line with the body tube.
- h. The eyepiece is the section at the top of the tube and is made up of a combination of lenses. Most eyepieces on student microscopes are 10X.
- i. The arm is the supporting structure between the base and the tube.
- j. The coarse adjustment is the larger of two wheels which is used to raise and lower the tube for a longer distance when focusing.
- k. The fine adjustment is the smaller of two wheels and is used for finer focusing, particularly with the high power objective.
- l. The magnification of any lens system is the product of the magnification of the eyepiece times the magnification of the objective being used.

Give the magnifying power of the eyepiece and each of the objectives of your microscope. Give the total magnifying power when using each of the objectives.

SUGGESTED PROCEDURES TO POINT OUT WHEN INSTRUCTING STUDENTS IN USE OF MICROSCOPES

- a. Place the microscope about one inch from the edge of a flat table so that the arm is toward the student.
- b. Check the microscope for dirty lenses and clean them with special lens paper furnished by the teacher.
- c. Rotate the nosepiece until the low-power objective (lowest number) is in place.
- d. As you observe the stage and tube from the side, turn the coarse adjustment clockwise until the low power objective is lowered to about one quarter inch above the stage.
- e. Adjust the diaphragm for the proper light.
- f. Specimen must be thin enough for light to pass through.
- g. The specimen should be placed in the center of a clean slide.
- h. Either a drop of water or a drop of stain should be placed on the specimen to keep it moist and keep it in place.
- i. The coverslip should be placed very carefully so as not to trap air bubbles.
- j. Place the prepared slide directly below the low-powered objective.
- k. Look through the eyepiece, keeping both eyes open.
- l. Slowly rotate the coarse adjustment counterclockwise. This will raise the tube and bring the specimen into focus.
- m. After observing using the low power objective, carefully rotate the high power objective into place.
- n. Slowly turn the fine adjustment until the specimen is in sharpest focus.

Microscope Parts Identification



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MICROSCOPE LAB

USING THE LETTER "e"

Use the low power objective to observe the letter "e" on a prepared slide. Your teacher may have you prepare your own slide. Rotate to the high power objective and note the change.

In the spaces below, draw "e" as it appears under the microscope:

LOW POWER

HIGH POWER

Rotate back to the low power.

Move the slide slowly under low power to the left. How does the letter seem to move? _____.

Move the slide upward. How does the letter seem to move? _____.

Completion:

1. Before you start to focus always check to see if _____ objective is in place and has been _____ lowered to just above the slide.
2. To focus, use the _____ adjustment first to _____ the body tube and objective.
3. To regulate amount of light use the _____.
4. Do not use coarse adjustment with the _____ objective.
5. Magnification of microscope

 Eyepiece 10X, low power _____ X
 Total magnification = _____

 Eyepiece 10X high power _____ X
 Total magnification = _____

6. Tell why the letter "e" was chosen for this experiment rather than an "o" or "w".

Chapter 2: What Does Being Alive Mean?

Advanced Preparation: None

Major Concepts to be taught:

The development of life functions
The organization of living things

Instructional Objectives:

The student should be able to -
State, define, and spell the life functions.
Recognize the organization of living things from cell to organism.

Assessment:

The student will:
Define and give the purpose of the following life functions:
metabolism, growth, responsiveness, and reproduction.
State the levels of organization in a living thing.

Materials:

Textbook: Exploring Living Things, pp. 28-37
References: Teacher's Overview, pp. T15-16

Laboratory Experiments:

What are the responses of an amoeba to light and to salt water? p.32
Activity No. 3: Responsiveness, pp.11-14, Activity Booklet

Films:

6098 - Life in a Drop of Water, 10 minutes
M4248 - Balance in Nature, 17 minutes
M6013 - Nature of Life: The Living Cell, 14 minutes
M3242 - Cell Biology: Life Functions, 19 minutes
M2308 - Tissues of the Human Body, 16 minutes

Suggested Activities:

Find Out More, p.29
Find Out More, p.33
Find Out More, p.35
Do It Yourself, p.36

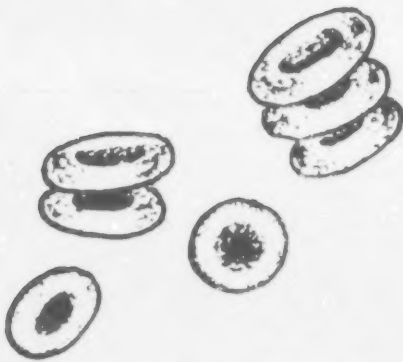
Checking Up: Vocabulary, p.38
Knowledge and Understanding, p.39
Concepts, p.39
Application and Critical Thinking, p.39
Doing More, Questions 1 and 2, p.39
Investigate On Your Own, Question 2, p.94
Specialized Cells Sheet, in guide

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Distinguish the difference between theories and facts. Recognize the composition and formation of organic compounds. Identify the first cells formed and how larger cells might have formed from them.	Have the students read Chapter 25, pp. 482-495, and as a classroom activity students may draw a chart listing facts from the chapter in one column and theories in another. Students may then describe the differences between the two terms. Students may do library research on legends of how life began, as handed down by various Indian tribes. *Investigate: How can you tell if something contains organic compounds? p.487. Organic Compound Game. Teacher Strategy for pp.484-485, T128. @Teacher Strategy for p.488, T128, on the formation of organic compounds. @Have students do research on Stanley L. Miller's synthesis of organic compounds, p.488. @Doing More, Question No. 1, p.499. Investigate: How can you prove that enzymes help break down food? Find Out More, p.495. *Have students rearrange the order of these terms to show the formation of early life: cell, organic compounds, organism, protein; then describe the reasoning behind the organization scheme. Doing More, Question No. 2, p.499.

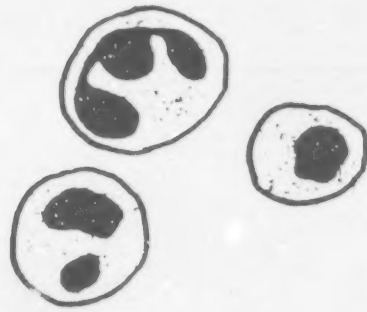
PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- State, define and spell the life functions.	Have students read Chapter 2 and discuss the questions in the margins and the blue starred questions orally. *Collect examples of living and non-living things (pictures or actual objects). Have students (1) list objects as living or non-living and (2) list the differences in characteristics between living and non-living things. Have students give examples of growth, metabolism, responsiveness, and reproduction to show understanding of life functions. *Bulletin Board or Poster Project. Students may make a display of the life processes using pictures. Find Out More, p.29. Find Out More, p.33. Investigate: What are the responses of an amoeba to light and to salt water? p.32 (Amoeba are available from the Oceanography and Living Resource Center.) Activity No. 3: Responsiveness, pp.11-14 Activity Booklet. Teaching Strategy for p.32, T17. Suggestions for testing responses of other living things. Doing More, Question No. 1, p.39. @Have students research viruses and see whether or not they are considered to possess the life processes. Research on viral diseases can be applicable here. Examples are tobacco and tomato leaf mosaic, rabies, small pox, polio, mumps, influenza, and yellow fever.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Recognize the organization of living things from cell to organism.	Have students make a chart of levels of organization on p.35. Then have students do Activity: Do It Yourself, p.36 to complete chart. Some may draw illustrations or cut out and paste in to complete chart. Show the "Building Blocks" of cells -- tissues -- organ -- system. Students may compare construction of a house to a body system. (foundation, framework, wiring, etc.) Teaching Strategy for pp.34-35, T18. Teaching Strategy for pp.35-36, T18.

SPECIALIZED CELLS



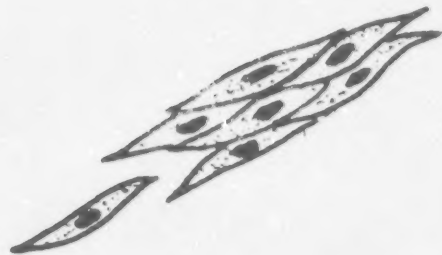
RED BLOOD CELLS



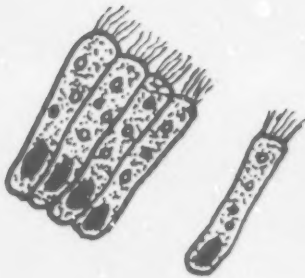
WHITE BLOOD CELLS



VOLUNTARY MUSCLE



INVOLUNTARY MUSCLE



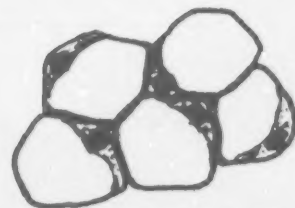
WINDPIPE LINING CELLS



NERVE CELLS



BONE CELLS



FAT CELLS

Chapter 25: How Life May Have Begun

Advanced Preparations:

1. Order specimens that illustrate the three classification kingdoms for Chapter 4.

Major Concepts to be taught:

Recognition of the composition of organisms
The recognition of the many theories of how life began
Understanding how living things change through time

Instructional Objectives:

- The student should be able to -
- Distinguish the difference between theories and facts.
 - Recognize the composition and formation of organic compounds.
 - Identify the first cells formed and how larger cells might have formed from them.
 - Define, identify, and spell terms relating to the beginnings of life.

Assessment:

- The student will:
- List two facts concerning early life.
 - List two theories explaining origin, composition and changes of early life.
 - List the elements found in all living things.
 - Explain that the first organisms may have been like protists and made of one cell.
 - Explain how cells could have formed from sea water.
 - Identify on sight and spell correctly: organic compound, gene, protist, life function, theory, enzymes, photosynthesis, and fossils.
 - E*Explain the importance of cells that act as photosynthesizers.

Materials:

Textbook: Exploring Living Things, pp. 482-495
Reference: Teacher's Overview, pp. T126-127

Laboratory Experiments:

How can you tell if something contains organic compounds?
How can you prove that enzymes help break down food? p.492
(May be used as a home assignment for extra credit.)

Films:

- L6830 - Life Begins at Sea, 24 minutes
- L6882 - The Endless Sea, 29 minutes
- *L2981 - The Sea, 27 minutes
- *L4317 - Animal Secrets: Beginnings, The, 24 minutes

Suggested Activities:

- Find Out More, p.494
- Find Out More, p.495
- Do It Yourself, p.496
- Checking Up: Vocabulary p.498
 - Knowledge and Understanding, p.499
 - Concepts, p.499
 - Application and Critical Thinking, p.499
- Doing More, p.499

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Define, identify, and spell terms relating to the beginning of life.	Discuss the questions in the margin as a classroom activity. Have a spelling bee or have students write out vocabulary words: <u>organic compound</u>, <u>gene</u>, <u>protist</u>, <u>life function</u>, <u>theory</u>, <u>enzyme</u>, <u>photosynthesizer</u>, <u>chlorophyll</u>, <u>fossil</u>. This could be the time to introduce the concept of photosynthesis and the importance of green plants to life on earth. *Discuss p.494, For You To Think About, and starred question on p.496. To show that green plants produce a food, starch, boil geranium leaves in a test tube 1/3 filled with alcohol. (Use a water bath) The green fluid will illustrate the organic compound chlorophyll. *Students can then use the iodine test for starch on the remains of the leaf. *Do It Yourself, p.496. @Teaching Strategy for p.496, T130.

Chapter 4: Classifying Living Things

Advanced Preparations: None

Major Concepts to be taught:

The necessity of classifying living things
The development of taxonomy by scientific names
The groups used in classifying living things

Instructional Objectives:

The student should be able to -
Recognize the history of the field of taxonomy.
Explain that classification is based upon likenesses and differences in structure.
Distinguish between plant, animal and protist.
Identify and associate the phyla of the animal kingdom with their animal types.
Recognize the usefulness and complexity of the binomial system.

Assessment:

The student will:
Name the person who developed the binomial system and the language used for classifying animals.
List the two groups that belong in the binomial system.
List the classification groups: Kingdom, phylum, class, order, family, genus, and species in the proper order.
Select from a list of genera and species the classification of man: *Homo sapiens*.
List differences and similarities between two different living things.
Identify the three main kingdoms as plant, animal and protist.
Use the phyla porifera, coelenterata, annelida, mollusca, echinodermata, and anthropoda; identify two animals in each phylum.
Name five classes of the chordata phylum, vertebrata subphylum.
Give the common name for the following: *Homo sapiens*, *Felis leo*, *Canis familiaris*, *Equus caballus*, *Lumbricus terrestris*, *Felis tigris*, *Bufo boreas*, *Mus musculus*, *Zea mays*, *Phizopus nigricans*.

Materials:

Textbook: Exploring Living Things, pp.60-76 (Catalog of Living Things on pp.77-88)

References: Teacher's Overview, pp. T24-25

Laboratory Experiments:

Do It Yourself: Classifying Living Things, p.65.

Do It Yourself: Observe Living Things and Classify Them, p.76.

Activity No. 8: Classification, pp.27-28, Activity Booklet

Films:

F6086 - Adaptations of Birds, 11 minutes

M6901 - Animal Classification, 12 minutes

L6227 - Hidden World: Insects, 24 minutes

M5977 - The Honey Bee, 12 minutes

L6247 - Wonderful World of Wildlife, 28 minutes

M2672 - Distribution of Plants and Animals, 16 minutes

5745 - Pond Animals, 11 minutes

Suggested Activities:

Find Out More, p.65

Do it Yourself, p.65

Find Out More, p.67

Find Out More, p.75

Do It Yourself, p.76

Careers, p.89

Pros and Cons, pp.92-93

Investigate On Your Own, pp.94-95

Summing Up, p.90

Checking Up: Vocabulary, p.90

Knowledge and Understanding, pp.90-91

Concepts, p.91

Application and Critical Thinking, p.91

Doing More, Questions 1 and 2, p.91

Read On Your Own, p.95. Contains a list of books on this topic for reading for those interested in this topic.

Crossword Puzzle on "Living Units" for students to work out as a fun activity. This will reinforce vocabulary learning abilities, in Appendix.

Grouping the Chordata Phylum Activity, in guide.

Investigation: Names and What They Mean, in guide.

Classification of Shapes Activity, in guide.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Recognize the history of the field of taxonomy.	Read Chapter 4, pp.60-76, and go over questions in margin orally with class. Assign students to do reports with library research on Aristotle, Linnaeus, and John Ray and give five-minute talks on their contributions to taxonomy. Discuss Careers section, p.90.
Explain that classification is based upon likenesses and differences in structure.	*Classification of Shapes Activity. Included in guide. Have students collect drawings of living things that have similarities in structure. (Possible Examples: organisms that have 1) wings, 2) fins, 3) four legs, 4) six legs, 5) eight legs, 6) no legs, 7) green leaves, etc.) Then list differences between the organisms in each group. Using live organisms, preserved specimens, or drawings, set up stations consisting of two organisms each in different parts of the room. Groups of students may then list differences and similarities between each group of organisms. (Examples of groups could include: 1) turtle and armadillo, 2) bird and butterfly, 3) cactus and fern, 4) carrot and rose, 5) earthworm and garter snake, etc.) Teaching Strategy for p.69, T26-27.
Distinguish between plant, animal, and protist.	*Picture collection of plants and animals; group response on differences and similarities of plants and animals. Students can add to their animal picture collection and collect as many different plant types as possible. With these pictures and specimens the students should be able to

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Suggested Student Projects: *Collect twenty animal pictures from magazines and newspapers. Bring to class and group illustrations according to similarities of animal characteristics. Collect at least ten insects. Place them in groups according to their similarities. NOTE: DO NOT USE CARBON TETRACHLORIDE..THE FUMES ARE POISONOUS. Collect as many Arthropods as possible. (crustaceans, centipedes, millipedes, arachnids and insects). Group them together according to the number of legs and antennae. *Bring an illustration of a fish, a frog, and a toad; a snake, a bird, and a mammal. Give specific characteristics. Study an animal that could be found in your neighborhood (squirrel, bird, insect, dog, cat, fish, etc.) Observe the animal and its surroundings; share the information with the class. Do It Yourself: Observing Living Things and Classifying them, p.76. @Investigate On Your Own, pp.94-95.
Recognize the usefulness and complexity of the binomial system.	Find Out More, p.65. For You To Think About, p.69. *Have students copy chart on p.70.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	"Investigation: Names and What They Mean." Can be used as a lab exercise, classroom activity, or extra work for interested students. *Write a list of genus and species names on the board and have the students locate the common name for each, using A Catalogue of Living Things pp.77-88 and pp.64-65. (See Assessment No. 9) Using references, look up the Latin meaning of <i>homo sapiens</i> (thinking man.) Note: Greek <i>homo</i> means "same" and should not be confused with the Latin <i>homo</i> meaning "man." Latin <i>sapiens</i> means "to be wise." Key for learning subdivisions of the Kingdoms: Kingdom Phylum Class Order Family Genus species <u>King</u> <u>Phillip</u> <u>Came</u> <u>Over</u> <u>For</u> <u>Good</u> <u>suppers</u>!

GROUPING THE CHORDATA PHYLUM

Like animals are put together in groups.

One such group in the chordata phylum.

Most of these animals have a backbone.

The chordata phylum is split into groups of similar animals.

Each animal named on the chart is like a group of other animals.

Use your science book to find out about these animals and place an X in the proper place to show which group each animal is in.

GROUP

Animal	Like Fish Bony Fish	Like Frogs Amphibians	Like Snakes Reptiles	Like Birds Birds	Like Cat Mammals
toad					
trout					
robin					
tiger					
turtle					
duck					
salamander					
salmon					
cougar					
alligator					

INVESTIGATION: NAMES AND WHAT THEY MEAN

Imagine yourself as a scientist who has collected the eight organisms pictured. The people of the area you collected in have furnished you with common names for the organisms. Your task is to make up descriptive scientific names for these organisms.

Procedure:

Study the list of descriptive Latin or Greek terms. These are words that can be used to "classify" organisms. You may combine one or two words to describe an organism.

VOCABULARY

bates	climber	lineatus	lined
bi	two	melano	black
campus	sea monster	myrmeco	ant
cephalus	head	nocti	at night
cordi	heart shaped	octo	eight
cornis	horn	petala	petal
curvi	curved or bent	paŋga	eat
dentata	toothed (plant leaf)	platy	flat
domesticus	found around house	punctata	dotted
folium	leaf (folia for species)	rhino	nose
hippo	horse	rostra	beak or bill (bird)
hylo	tree	sex	six
leuco	white	tri	three
vagens	travel or wander		

Study the drawings and common names in the illustrations. Look through the list again for descriptive terms. For example, a Giant Panda. It is black and white. Search the list for the words black and white (black—melano, white—leuco). if we put these words together, *melanoleuca*, we get a description of a black and white animal—and that IS the species name for the Giant Panda.

Use the Latin or Greek words listed and construct a scientific name for each of the organisms. Discuss the names you have chosen.

(To the Teacher) It is important that the names suggested by the students be received with serious consideration. This is a good time to establish an atmosphere in which students feel free to suggest their own ideas.

On the chalkboard, list the genus or species names chosen by students and discuss why the names were chosen. It is not intended that students memorize scientific names or terms. The point to be made is that these names and terms are descriptive and that a "useful" language is used to facilitate communication.

Common Name	Part Of Scientific Name To Be Derived By Students	Genus And/Or Species Name
Six-lined Race Runner	species	<i>Cnemidophorus sexlineatus</i>
Mountain Dryad	species	<i>Dryas octopetala</i>
Anteater	genus	<i>Myrmecophaga</i>
Sagebrush	species	<i>Artemisia tridentata</i>
Bald Eagle	species	<i>Haliaeetus leucocephalus</i>
Seahorse	genus	<i>Hippocampus</i>
Two-spot ladybird Beetle	species	<i>Coccinella bipunctata</i>
Heart-leaf Arnica	species	<i>Arnica cordifolia</i>
Rhinoceros	species	<i>Rhinoceros bicornis</i>
Silver-haired Bat	species	<i>Lasionycteris noctivagans</i>
Common House fly	species	<i>Musca domesticus</i>
Gibbon	genus	<i>Hylobates</i>
Hog-nosed Snake	species	<i>Heterodon platyrhinos</i>
Red Crossbill	species	<i>Loria curvirostra</i>
Clover	genus	<i>Trifolium</i>

Science 7 — Investigation — Names and What They Mean
(Classification)



Rhinoceros (*bicornis*)



Mountain Dryad
(*octopetala*)



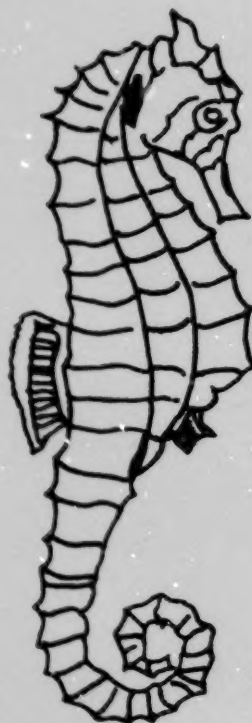
Hog-nosed Snake
(*platyrhinos*)



Six-Lined Race Runner
(*sexlineatus*)



Two-Spot Ladybird Beetle
(*bipunctata*)



Seahorse (*Hippocampus*)



Clover (*Trifolium*)



Heart-Leaf Arnica
(*cordifolia*)

CLASSIFICATION

1. Classify the objects below into two kingdoms:

Kingdom 1

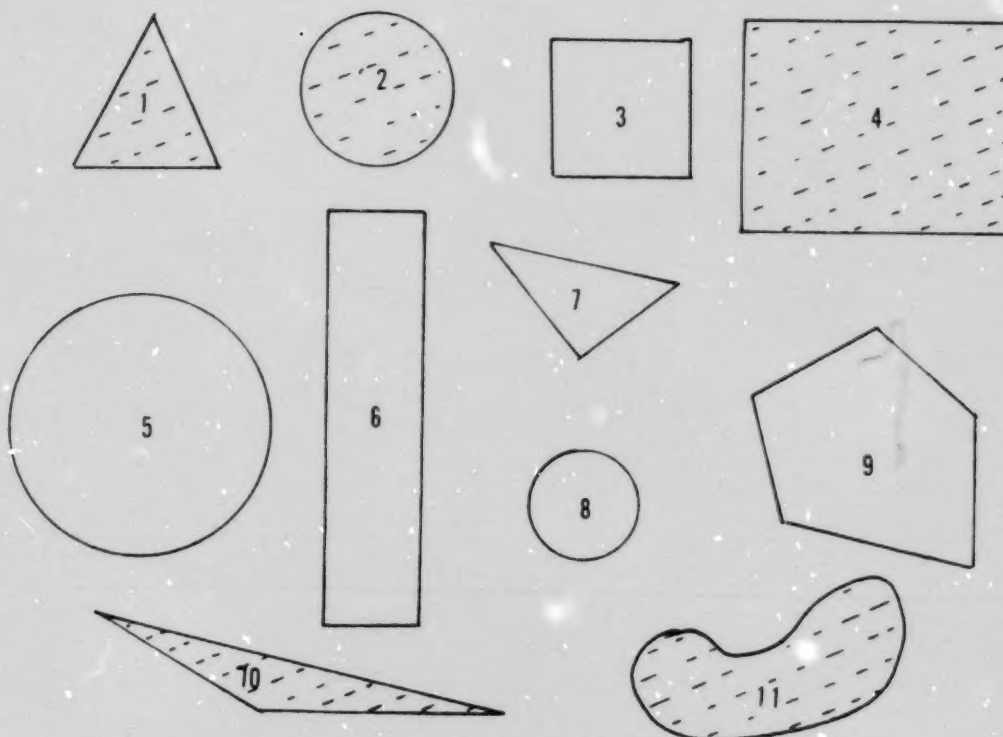
Kingdom 2

Name: _____

Name: _____

Members: _____

Members: _____



2. Break one of your Kingdoms into two or three phyla:

Phylum 1

Phylum 2

Name: _____

Name: _____

Members: _____

Members: _____

Phylum 3

Name: _____

Members: _____

3. After comparing your classification with those of at least three of your classmates, discuss what it means to classify.

UNIT 2

ECOLOGY: THE SCIENCE OF SURVIVAL

Time Allotment:
25 days for entire unit

Chapter 5: Two Problems in Ecology

Advanced Preparations: None

Major Concepts to be taught:

Relationship of the environment and ecology
Problem of food
Effect of pollution on the environment

Instructional Objectives:

The student should be able to -
Recognize the relationship between environment and ecology.
Explain how people have changed the environment.
Identify environmental problems associated with providing food for the world.
Identify sources of pollution.
Explain how pollution changes the environment.
Identify ways to help stop pollution.

Assessment:

The student will:
Identify and spell correctly the terms environment and ecology.
List beneficial and harmful ways people have changed the environment.
Recognize three problems and hypothesize three possible solutions in providing food for the world.
Observe carefully and identify sources of pollution in the community.
Identify changes in the environment caused by organic wastes, burning fuel, chemicals, detergents, and garbage.
Collect data on pollution.
Describe at least three ways in which to personally cut down on pollution.

Materials:

Textbook: Exploring Living Things, pp. 98-115
Reference: Teacher's Overview, pp. T31-35

Laboratory Experiments:

Investigate: How can you find out if living things are using up oxygen in the water? p.111

Films:

- M7212 - Ecology: Relationship of Plants and Animals to Their Environment, 22 minutes
- L6192 - Nature Has An Answer, 18 minutes
- M4625 - Your Environment is the Earth, 12 minutes
- 4620 - Air Pollution, 10 minutes
- M7627 - Food: Surviving the Chemical Feast, 17 minutes
- 3362 - Plankton: Pastures of the Ocean, 10 minutes
- M3361 - Waterfowl: A Resource in Danger, 17 minutes
- L5456 - What Are We Doing to Our World, I, 27 minutes
- L5457 - What Are We Doing to Our World, II, 25 minutes

Suggested Activities

Summing Up, page 114

Checking Up: Vocabulary, p.114

Knowledge and Understanding, p.114

Concepts, p.115

Application and Critical Thinking, p.115.

Doing More, Questions 1 and 2, p.115

Do It Yourself, p.100

Find Out More, p.103

Do It Yourself, p.107

Find Out More, p.106

Find Out More, p.112

Investigate On Your Own, p.190

Teaching Strategy for p.99, T32

Teaching Strategy for p.100, T32

Teaching Strategy for p.109, T34

In guide:

The Effects of Detergents on the Growth of Algae in Ponds and Streams

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Recognize the relationship between the environment and ecology.	The student shall read Chapter 5 and go over questions in margin orally in class. Have students orally discuss reasons for studying the environment. Have students write poems, essays, limericks or draw cartoons with ecology themes and display them in the room. *Have students locate a particular area on the school grounds. Make drawings of what is found: trash, rocks, trees, insects, etc. Make sketches for several weeks, recording changes found each week. Teaching strategy for p.99, list things in environment, T32
Explain how people have changed the environment	Have students list several ways people have altered the balance in nature. How have people attempted to control imbalance? Do It Yourself, Look for changes in the environment, p.100. Teaching Strategy for p.100, Change the environment, T32
Identify environmental problems associated with providing food for the world.	Find Out More, p.103 Find Out More, p.106 Do It Yourself, Preserve some Food, p.107 Doing More, No.1, p.115 Investigate On Your Own, No. 1, p.190 Research into organic gardening techniques. Perhaps the students can start a school garden using these techniques.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students research into other ways to control pests than by using poisons. Teaching Strategy for pp.104-105, Activity with fertilizers, T33 Teaching Strategy for pp.106-107, Sources of future food, T33
Identify sources of pollution	Doing More, Observing Pollution in the Neighborhood, No. 2, p.115 Teaching Strategy for p.109, Garbage Pollution, T34 Students can collect newspaper articles or magazine articles on pollution. Make a poster showing different sources of pollution. Students can prepare a series of five or six glass slides, number each slide and spread a thin coat of vaseline on each. Place slides in various locations of room, school building, and outside area. Record number of slide, location, time of sampling. Next day collect slides and use microscope or hand lens to count number of particles. Use a bar graph to graph the number of particles for each location. Have students estimate the number of automobiles in the Houston area and estimate the amount of pollutants added to the air each day by them. Get a tape recorder and record sounds in various locations of the school, the library, office, classrooms, lunch room, gym area, street, and if possible other areas such as a factory, airport, and supermarket. Be sure to use the same power to record in each place. Narrate on the tape the locations. Class discussion can be on deciding the loudest

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES																				
The student will --	sounds, the most noise for the longest times, etc.																				
Explain how pollution changes the environment	Investigate: How can you find out if living things are using up oxygen in the water?, p.111 Students can design an experiment using algae, water and phosphate detergent to show effects of phosphates on plant growth. Observe and write conclusions. See activity included in guide: The Effect of Detergents on the Growth of Algae in Ponds and Streams. Students can research into the effects of noise pollution, the SST controversy and the banning of "sonic boom" flights over populated areas. Students can list and research health problems that may be caused or worsened by pollution. <table> <tr> <td>allergies</td><td>heart diseases</td></tr> <tr> <td>asthma</td><td>high blood pressure</td></tr> <tr> <td>bronchitis</td><td>nerve disorders</td></tr> <tr> <td>cancer</td><td>pneumonia</td></tr> <tr> <td>coughs</td><td>skin irritations</td></tr> <tr> <td>emphysema</td><td>throat irritations</td></tr> <tr> <td>eye irritations</td><td></td></tr> <tr> <td>lead poisoning</td><td></td></tr> <tr> <td>headaches</td><td></td></tr> <tr> <td>hearing loss</td><td></td></tr> </table>	allergies	heart diseases	asthma	high blood pressure	bronchitis	nerve disorders	cancer	pneumonia	coughs	skin irritations	emphysema	throat irritations	eye irritations		lead poisoning		headaches		hearing loss	
allergies	heart diseases																				
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emphysema	throat irritations																				
eye irritations																					
lead poisoning																					
headaches																					
hearing loss																					
Identify ways to help stop pollution	Find Out More, p.112 Have students create a saying for a billboard or bumper sticker to help fight air pollution. *Think up ways to slow down pollution by automobiles. <table> <tr> <td>1. car pools</td><td>4. mass transit</td></tr> <tr> <td>2. bicycling</td><td>5. etc.</td></tr> <tr> <td>3. walking</td><td></td></tr> </table>	1. car pools	4. mass transit	2. bicycling	5. etc.	3. walking															
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3. walking																					

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Brainstorm kinds of air pollution (Put on board) Divide class into groups of 3 or 4. Each group picks one kind of air pollution and will orally demonstrate what causes their kind of air pollution, and offer suggestions as to what can be done to improve air quality. @Have students investigate several areas of the pollution controversy (auto emissions, nuclear energy, industrial pollution). Report on the problem, possible solutions, and costs of correcting the problem vs. not correcting it. Students could role play using the information they gather, ex: a nuclear energy developer vs. a solar energy proponent or an environmentalist vs an industrialist Have students write the Environmental Protection Agency in Houston to ask what is being done to improve the quality of air in the area. Research steps involved in the recycling of paper, glass, aluminum, steel and rubber. Have students compose a list of suggestions for recycling in the home and duplicate to be sent home. Have an exhibit day of items made from recycled materials. Develop a school recycling program.

THE EFFECT OF DETERGENTS ON THE GROWTH OF ALGAE IN PONDS AND STREAMS

Objectives

At the end of this activity the student should be able to

- . Demonstrate the effect of commonly used washing detergent on the growth of algae (algae bloom) in fresh water ponds and streams
- . Contrast the growth of algae in two samples of fresh water--one with detergent and one without detergent
- . Infer the condition of algae growth in ponds and streams that are polluted with detergent and in those that are not polluted

Materials

- 2 gm of detergent commonly used for washing clothes or dishes in the home
- 2 wide-mouth glass jars such as pickle or mayonnaise containers
- Culture of fresh water algae such as that growing in stock ponds, open ditches, bayous, fish aquaria
- 2 liters of distilled water
- 1 light source such as a table lamp or projector

How to Get Started

- . What effect does the home dishwashing and automatic washer detergent have on the growth of algae in our fresh water ponds, lakes, and streams?
- . Why is the amount of algae growth in ponds and streams important to us?
- . How can dumping washer suds into our sewers affect fishing at a

favorite lake or river? If this is a problem what can we do about it?

What to Do in the Lab

Prepare a .1% solution of any common dishwashing detergent by dissolving 2 grams of the detergent in approximately 2 liters of water.

Fill one or several one-gallon jars with the detergent mixture and add one tablespoonful of green algae culture per bottle.

Fill several other one-gallon jars with distilled water and add exactly one tablespoon of algae to each bottle.

Cover the jars with a piece of cardboard or aluminium foil and allow them to stand, side by side, about 1/2 meter away from a 100-watt lamp in continuous operation.

Observe the jars every week for a period of several weeks and describe the color, density, and general appearance of the contents of each jar.

Where to Go from Here

- . How does the color of the algae growing in the detergent solution compare with the color of the algae growing in the distilled water and why?
- . Which solution would be best to grow fish in?
- . What was the purpose of the 100-watt lamp in this experiment?
- . Which solution would most closely compare to a polluted stream or pond?
- . If this algae growth is bad for fish and other small pond life, how can we stop polluting ponds and streams with phosphates from washing detergents?

Other Things to Do

Test several different brands of detergent to determine if there is any difference in the effect which they have upon the growth of algae.

Chapter 6: The Physical Environment

Advanced Preparations:

1. Prepare flats of available seeds for experiment on page 147, Chapter 7.

Major Concepts to be taught:

Relationship of soil and the environment
Relationship of water and the environment
Relationship of air and the environment
Development of limits of tolerance

Instructional Objectives:

The student should be able to -

Describe the composition and identify the uses of soil.
Differentiate between pure water, fresh water, and salt water.

Recognize the influence of limiting factors in the environment.

Explain the importance of air to the environment.

Assessment:

The student will:

Identify, observe and collect data on the three main components of soil.

Describe a major use of soil.

List differences and similarities between pure, fresh, and salt water.

Identify a limiting factor in the environment.

Identify one way in which nitrogen, oxygen and carbon dioxide are each important to living things.

Materials:

Textbook: Exploring Living Things, pp.116-135

Reference: Teacher's Overview, pp.T36-40

Laboratory Experiments:

Do It Yourself, Examine Soil, p.117

Do It Yourself, Collect Small Animals from Soil, p.120

Investigate: How do ocean water, river or pond water and tap water differ in the amount of materials they contain? p.124

Investigate: How can you observe the nitrogen-fixing bacteria? p.130.

Activity No. 9: Soil Characteristics, pp.29-34

Films:

- M2939 - Water and Life, 15 minutes
- M2996 - Physical Environment, 11 minutes
- 4359 - Plant, Animal Communities, Physical Environment, 11 minutes
- M4475 - Problems of Conservation: Air, 15 minutes
- M7120 - Safe Water: The High Cost of Drinking, 15 minutes
- M3852 - Water Harvesting, 16 minutes
- M5451 - What in the World is Water, 12 minutes

Suggested Activities:

- Find Out More, p.118
- Find Out More, p.123
- Find Out More, p.125
- Find Out More, p.131
- Doing More, Questions 1 and 2, p.135
- Teaching Strategy for p.119, T37
- Teaching Strategy for pp.122-123, T38
- Teaching Strategy for pp.125-126, T38
- Teaching Strategy for p.132, T40

In guide:

Organic Material in the Soil and Its Effect Upon the Growth of Plants

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will - Describe the composition and identify the uses of soil.	Read Chapter 6 and orally discuss questions in the margins. Do It Yourself, Examine Soil, p.117 Find Out More, p.118 Do It Yourself, Collect Small Animals from Soil, p.120 Teaching Strategy for pp.119-120, Investigate soil, T37. Doing More, No. 1, p.135 Teaching Strategy for p.119, Demonstrate importance of humus in soil, T37. Using the low power of a microscope, students can examine samples of clay, silt, and loam in drops of water. Make drawings to show differences in particle size. Research into how the composition of each soil type differs. Have students obtain soil samples from different areas (backyard, school yard, forest, field, etc.) and one sample from several feet beneath the soil surface. Put them in different jars and label them. Moisten and test with litmus paper to determine if the soil is acidic or basic. Do research to find what makes soil acidic or basic. Make a chart listing plants that grow in acid soil and those that grow in basic soil. @Research into the purifying ability of soil to help remove and change pollutants from the air and water. (carbon monoxide, ethylene, sulfur dioxide, nitrogen dioxide)

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	*To duplicate nature's filtering process: Plug a hole in the bottom of a flower pot with cotton. Add layers of sand and charcoal. Pour muddy water into the pot, allowing it to drain into a glass jar. Students can write down observations and conclusions. Sink an empty can with both ends removed halfway into the soil in several areas. Add a given amount of water and compare times of water draining into the soil. Activity No. 9: Soil Characteristics, pp.29-34, (Metric measurement using a ruler, graduated cylinder, and a balance) Activity included in guide: Organic Material in the Soil and its Effect Upon the Growth of Plants.
Differentiate between pure water, fresh water, and salt water.	Find Out More, p.123. Research into how salt water is converted into fresh water for large scale use. Investigate: How do ocean water, pond water and tap water differ?, p.124 (Metric measurement using a balance) Teaching Strategy for pp.122-123, Distinguish between pure and fresh water, T38. Doing More, No. 2, p.135. Have students locate the source of Houston's water supply. What problems are connected with this supply? Collect rain water, ditch water, pond water, and drinking water. Place each in a separate jar, allow them to settle for a few days. Observe each jar and write data on color, smell, drinkability, and debris of each.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Recognize the influence of limiting factors in the environment. Explain the importance of air to the environment.	Find Out More, p.125. Teaching Strategy for pp.125-126, Limits of Tolerance, T38. Have students plan an experiment designed to test the resistance of a seed to the temperature of boiling water. Have students plant seeds in pots and compare their growth under varying conditions of light, temperature, and moisture. For example, place one pot in a well lighted window, one in a dark corner, one in a drafty spot, one near a heater, one outside, one overwatered and one watered infrequently. Record observations. Graph growth in cm. vs days for each condition. Investigate: How can you observe the nitrogen-fixing bacteria?, p.130. Find Out More, p.131. Students can make a drawing of the nitrogen cycle. Use p.129 and other resources. Teaching Strategy for p.132, Test for CO₂ T40. Have students make a chart of the three gases: nitrogen, oxygen and carbon dioxide, listing how each is important to living things. Emphasis on the importance of green plants to man and the use of carbon dioxide as a raw material in photosynthesis can be made at this point.

ORGANIC MATERIAL IN THE SOIL AND ITS EFFECT UPON THE GROWTH OF PLANTS

Objectives

At the end of this activity the student should be able to

- Demonstrate the need growing plants have for humus (decaying animal and plant matter) in the soil
- Measure the daily growth of plants under different conditions of soil humus and construct a graph to illustrate any variation of growth observed

Materials

Clean builder's sharp sand or bird gravel
Distilled water
Organic material such as grass clippings, rice, ground beans, ground insects, or breakfast cereal
Package bean seeds
Flower pots, plastic planting containers, or milk cartons

How To Get Started

- How does the process of decay make it possible for new plants to grow?
- What is the substance in decaying plants and animals that causes plants to grow more rapidly?
- What is the purpose of fertilizing lawns, gardens and flowers?
- Why are fertilizers of little use unless accompanied by water?

What to do in the Lab

Obtain a sample of clean sand such as builder's sharp sand or bird gravel, wash thoroughly with distilled water, and divide into two samples. Place a sample of the clean washed sand in flower pots or plastic containers and plant a bean seed in each pot approximately 2.5 cm below the surface of the sand. Mark these Group A.

Add a mixture of ground-up insects (grasshoppers, moths, flies) to the second sample and place in flower pots or plastic containers. Prepare a nutrient solution by grinding some organic material such as grass clippings, rice, beans, insect bodies, or breakfast cereal, and allow the mixture to stand in distilled water for several days. Decant the top liquid (pour off the clear liquid) without

solid materials into a clean container and cover. This liquid is a nutrient solution for plant growth. Plant a bean seed in each pot approximately 2.5 cm below the surface of the sand. Mark these Group B.

Water each sample with distilled water each day. Be sure that all other conditions such as sunlight, moisture, temperature, and size of container are the same for Group A and Group B. After the seeds germinate, measure the plant heights and leaf size each day and record for Group A and Group B. Observe the plants each day and record the color of plants in Group A and Group B.

It is important that as soon as the bean seeds germinate and the young plants are visible above the surface of the sand, the cotyledons, which are thick, leaf-like structures, should be removed to assure that all mineral requirements of the plant be obtained from the soil.

Group A Data

Group B Data

Where to Go from Here

Explain the reasons for changes in growth rate and changes in color of certain plants. Why was it necessary to allow the ground humus material to stand several days before placing it on the planted bean seeds? Why do you suppose the humus material which was ground and placed in the water solution resulted in a growth and color change?

Other Things to Do

Develop the same kind of activity using radish seeds or corn to determine likenesses and differences in the growth of such seeds under similar experimental and control conditions.

Try a variety of humus sources such as bonemeal, cream of wheat, and sawdust to determine the rate of decomposer activity on more or less soluble materials.

Chapter 7: The Biological Environment

Advanced preparations:

1. Collect leaves, twigs and pebbles from a pond for activity p.167 in Chapter 8.
2. Collect pond water for Activity 13 in Chapter 8.

Major Concepts to be taught:

Interrelationship between habitat and niche
Interactions between living things
Relationship between living things and energy

Instructional Objectives:

The student should be able to -
Distinguish between habitat and niche.
Explain how changes in the habitat can affect living things.
Describe interactions between living things that are neutral, helpful and harmful.
Recognize that all animals and plants are part of a food web containing several food chains.
Explain the relationship of living things in the energy pyramid.

Assessment:

The student will:
Describe an organism's habitat and niche.
Describe how changes in the habitat can cause an organism to become extinct.
Identify the difference between an herbivore, a carnivore, and an omnivore.
Define, spell and give examples of the different interrelationships between living things: neutralism, commensalism, mutualism, amensalism, producer-consumer, parasite-host, predator-prey, competition.
Construct a food chain diagram and give examples of producers, consumers, herbivores, carnivores, omnivores, decomposers, and nutrients.
E*Explain that a green plant is the basic link in every food chain.
Identify the source of energy for all living things and interpret a drawing, describe how the amount of energy changes from producers to consumers.

Materials:

Textbook: Exploring Living Things, pp.136-155

Reference: Teacher's Overview, pp.T40-45

Laboratory Experiments:

Investigate: How does competition affect plant growth? p. 147

Activity No. 10: Studying a Microhabitat, pp.35-38

Activity No. 11: Competition Among Plants, pp.39-40

Films:

M5372 - Grasslands Ecology: Habitats and Change, 13 minutes

M6962 - Day in Nature's Community, A, 17 minutes

M5693 - Nature's Camouflage, 13 minutes

M3286 - Marine Animals of the Open Coast: A Story of Adaptation, 22 minutes

M6541 - Nature's Strangest Creatures, 16 minutes

M6958 - Predators of the Desert, 22 minutes

5846 - Survival in the Animal World, 11 minutes

6001 - Food Chains in the Ocean, 9 minutes

5990 - Energy and Living Things, 11 minutes

L6491 - Eye to Eye with Wild Animals, 21 minutes

M2993 - Cave Community, The, 13 minutes

L2994 - High Arctic Biome, 25 minutes

M7631 - Protist Ecology, 12 minutes

Suggested Activities:

Summing Up, p.154

Checking Up: Vocabulary, p.154

Knowledge and Understanding, p.154

Concepts, O.155

Application and Critical Thinking, p.155

Doing More, Questions 1 and 2, p.155

Find Out More, p.144

Find Out More, p.150

Do It Yourself, p.142

Do It Yourself, p.151

Teaching Strategy for pp.138-139, T41

Teaching Strategy for p.142, T43

Teaching Strategy for p.143, T43

Teaching Strategy for pp.144-145, T43

In Guide:

Food Chain Information Sheet from Audobon Society

Food Web Exercise

Rescue Game

The Balanced Aquarium

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Distinguish between habitat and niche.	Have students read Chapter 7 as a class-room activity and discuss questions in the margin. Have students define <u>habitat</u>, <u>niche</u>, <u>herbivores</u>, <u>carnivores</u>, <u>omnivores</u>, <u>extinct</u>, <u>neutralism</u>, <u>commensalism</u>, <u>parasite</u>, <u>host</u>, <u>predator</u>, <u>prey</u>, <u>consumer</u>, <u>producer</u>, and <u>decomposer</u>. Use this as a spelling bee game. Students can measure an area of one square foot of their backyard to find out what is in it. Count the inhabitants. Describe the niche of one of the organisms. See page 155, Doing More. Students can map the area around the school. Research and discuss animals that have limited habitats. Examples could be penguins, kangaroos, polar bears, coral, desert rats, etc. Activity No. 10: Studying a Microhabitat, pp.35-38. (Metric measurement using a meter stick.) Teaching Strategy for pp.138-139, Niche Discussion, T41.
Explain how changes in the habitat can affect living things.	Do It Yourself, p.142. Find out which living things are in danger of becoming extinct. Ask the students to hypothesize various explanations for how the dinosaurs became extinct. List animals in nature that are decreasing in number and those species that are increasing and list reasons why man might be responsible for these changes.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students prepare a chart of various animals that illustrate adaptation for movement, food getting, or any other feature which contributes to the animal's survival. Another interesting chart could be on the adaptations for survival in unusual environments. Hypothesize on what would happen to the organisms if the environment changed. Mark off with string and sticks, a 10 meter x 10 meter square on a grassy spot of the school yard. Using a hole puncher, punch out 100 green, 100 red, 100 blue, and 100 yellow circles of construction paper. Have one student scatter the circles in the school yard square. The rest of the class (birds) have 5 minutes to search for the circles (insects). Count the number of each color collected. Hypothesize which color would be easiest and hardest to find. Hypothesize how the results would be different if the environment changed (from green grassy area to a brown grassy area). Class can make a data table of the findings and then draw conclusions.
Describe interactions between living things that are neutral, helpful or harmful.	Using text, pp.142-148, and other reference books, list examples of neutralism, commensalism, mutualism, amensalism, parasite-host, and predator-prey, competition. Find Out More, p.144. Investigate: How does competition affect plant growth? p.147. (Metric measurement using a ruler) Activity No. 11: Competition Among Plants, pp.39-40. (Metric measurement using a ruler) Teaching Strategy for p.142, Look for neighborhood interactions, T43.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Teaching Strategy for p.143, Study Lichens to show mutualism, T43. Teaching Strategy for pp.144-145, Field trip for animal parasites, T43. Research these animal behaviors: mating rituals, aggression, feeding, and establishing territorial rights. How do these behaviors lead to survival? Report on the discovery of penicillin. See p.144. Students may use other medicines which are helpful as extra reports. Predator-Prey Game. Put a list of animals up and have students pick one each. Then show how predator consumes the prey. Student joins the predator's team. The predator with the most prey wins. May use string to show how the interaction takes place. The predator holds on to the loose end of the prey's string.
Recognize that all animals and plants are part of a food web containing several food chains.	Students can draw diagram on p.150. Cut out and paste (or draw in) pictures to illustrate or define each square. Give the correct scientific name of each part. Do It Yourself, Draw a food-chain diagram, p.151.
E	Find out More, photosynthesis, p.150. Doing More, No. 2, p.155. Take a nature walk around the school area or home area (homework) looking for members of the food chain. Make a list of meat-eaters, plant-eaters, green plants, and decomposers that they see. *Construct a mobile to demonstrate the food chain.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	For homework, have each student trace the food chain leading to each food on his or her table tonight. Have students arrange the following organisms in such a way as to indicate a food chain: snakes, grasses, toads, herbivorous insects, spiders, animal eating insects, insectivorous birds, hawks and owls. Put a board on the ground in a damp area at home or on the school grounds for several days. Turn it over to observe the types of animals underneath it. Which are herbivores, carnivores, scavengers? *Assign each student a name of an animal. Set up several food chains and then a food web. Connect each animal to the other, using string or yarn. Allow students to see what would happen if one member of the web dropped out. Food chain information sheet from Audubon Society (included in guide) Food Web Exercise (included in guide) The Balanced Aquarium (included in guide)
Explain the relationship of living things in the energy pyramid.	Have students draw energy pyramid on p.152. Answer For You To Think About and starred questions p.162. *Cut out or draw examples of herbivores, plants, carnivores, and the sun. Place in order of amount of energy received (from most to least). E Hypothesize what would happen if plants were removed from the pyramid. Where would man get his energy? Have students play "Rescue," a game to save animals. Newspaper article is from "Houston Chronicle."

FOREST FOOD CHAINS

The following animals are listed with common food items which they consume. In some cases, young or eggs of the "food animal" may be eaten. This list was compiled from a chart by the Audubon Society for your reference in the food web exercise.

Owls - rabbits; insects (plant-eating); twig-feeding birds; squirrels; moles; mice; ground-feeding birds; leaf-feeding birds; trunk-feeding birds; shrews; insects (preying); skunks; hawks.

Bears - nuts; seeds; fruit; porcupines; rabbits; deer; insects (plant-eating); mice; turtles; shrews; frogs, toads; insects (preying)

Raccoons - nuts; seeds; fruit; earthworms; insects (plant-eating); moles; mice; turtles; shrews; frogs, toads; insects (preying)

Skunks - herbs; fruit; insects (plant-eating); moles; mice; turtles; ground-feeding birds; spiders; centipedes; snakes; frogs, toads; insects (preying)

Foxes - fruit; porcupines; rabbits; deer; insects (plant-eating); squirrels; mice; ground-feeding birds; shrews; snakes; frogs, toads; insects (preying); skunks; opossums

Bobcats - porcupines; rabbits; insects (plant-eating); twig-feeding birds; squirrels; mice; ground-feeding birds; trunk-feeding birds; shrews; owls; raccoons; skunks; opossums; hawks

Opossums - nuts; seeds; fruit; insect (plant-eating); twig-feeding birds; ground-feeding birds; leaf-feeding birds; trunk-feeding birds; insects (preying)

Hawks - rabbits; insects (plant-eating); twig-feeding birds; ground-feeding birds; leaf-feeding birds; trunk-feeding birds; shrews; snakes; insects (preying)

Spiders - millipeds; insects (plant-eating); centipedes; insects (preying)

Centipedes - insects (plant-eating); insects (preying)

Shrews - nuts; seeds; herbs; fruits; earthworms; millipeds; insects (plant-eating); moles; mice; spiders; centipedes; shrews; snakes; frogs, toads; insects (preying)

Snakes - earthworms; insects (plant-eating); twig-feeding birds; moles; mice; ground-feeding birds; leaf-feeding birds; trunk-feeding birds; spiders; centipedes; shrews; snakes; frog, toads; insects (preying)

Frogs, toads - earthworms; millipeds; insects (plant-eating); spiders; centipedes; insects (preying)

Insects (preying) - millipeds; insects (plant-eating); spiders; centipedes; frogs and toads; insects (preying)

Twig-feeding birds - seeds; insects (plant-eating); spiders; insects (preying)

Squirrels - bark; nuts; seeds; fungi; leaves; herbs; ferns; fruit; buds, twigs; twig-feeding birds; ground-feeding birds; leaf-feeding birds; trunk-feeding birds

Moles - seeds; herbs; earthworms; millipeds; insects (plant-eating); spiders; centipedes; insects (preying)

Mice - nuts; seeds; herbs; fruit; millipeds; insects (plant-eating); spiders; centipedes; insects (preying)

Turtles - seeds; fungi; leaves; fruit; earthworms; insects (plant-eating); insects (preying)

Ground-feeding birds - nuts; seeds; fruit; buds, twigs; earthworms; millipeds; insects (plant-eating); spiders; centipedes; insects (preying)

Leaf-feeding birds - seeds; insects (plant-eating); spiders; insects (preying)

Trunk-feeding birds - nuts; seeds; insects (plant-eating); spiders; insects (preying)

Porcupines - bark; nuts; leaves; herbs; fruit; buds, twigs

Rabbits - bark; grass; herbs; fruit; buds, twigs

Deer - nuts; grass; seeds; fungi; leaves; herbs; ferns; fruit; buds, twigs

Earthworms - grass; leaves; herbs; decaying matter

Millipeds - grass; herbs; decaying plants

Insects (plant-eating) - bark; nuts; grass; seeds; fungi; leaves; herbs; ferns; fruit; buds, twigs

FOOD WEB EXERCISE

The food web concepts are intended to develop within each student an understanding as to how every organism depends on and interacts with other organisms as well as the non-living environment.

Either assign or have each student select one organism from the following list. Emphasize that every organism is part of the natural life pattern and serves some purpose within nature.

Coyote	Vulture	Fly	Spider
Mouse	Algae	Man	Dog
Rabbit	Oak Tree	Bacteria	Cow
Snake	Cattails	Mold	Tapeworm
Grass	Hawk	Earthworm	Corn
Owl	Grasshopper	Sparrow	Flea
Snail	Duck	Fish	Beaver
Deer	Beetle	Toadstool	Cat
Raccoon	Louse	Fox	Wildcat
Bear	Woodpecker	Skunk	Praying Mantis
Wolf	Frog		

By choosing organisms from the suggested list, you will be able to illustrate most of the common relationships. If you have fewer students than organisms suggested, be sure the ones you choose will illustrate the various relationships that will be discussed.

The food web exercise will give the students a concrete experience from which they can develop terms and definitions to illustrate various ways organisms are interrelated. Allow at least 30 minutes for this activity. Nearly all the activities above can be integrated into a discussion during the food web exercise.

Students should arrange their desks in a circle, leaving enough room behind so that the teacher can walk on the outside. Tape a sign with the organism's name on the front of each student's desk where all others can see. Have a skein of yarn rolled into a ball before starting the exercise.

Start by asking one student representing a consumer (for example, the coyote) to select from the other organisms one he would eat in order to obtain food. Do not start with a producer. Connect the yarn between the "eater" and the "eaten." Continue connecting "eating" organisms to "eaten" organisms until all organisms are involved in at least one path. After discussing what some animals eat, select a green plant. If students do not realize green plants make food, rather than eat other organisms, review briefly how plants use sunlight, water, carbon dioxide, and minerals and produce food and release oxygen. Emphasize that all the other organisms depend directly or indirectly on the producers. Connect the yarn from the plants or organisms that eat the plants.

Continue connecting yarn between organisms until several of the students have two or more strings. Be sure each student realizes he represents a population (all organisms of one type), thereby can be eaten by several others.

Once you have connected sufficient strings, depending on the number of relationships and concepts you wish to illustrate, have all students tape the strings to their desks. Students may want to sketch the food web they formed before leaving the circle.

When you finish your food web, hang the signs and strings from the ceiling or room lights. This will allow students to view the food web over a period of time.

For additional work, the yarn food web can be used to demonstrate the many effects which occur when one or two "strands" of the web are destroyed.



Linda Rickard strokes the back of a tortoise, one of the endangered species of animals in Texas. She has learned about the turtle, and

its plight, by playing Rescue!, a game brought to her school by Houston Zoo volunteers. The do-cents visit in the Zoomobile.

Rescue! It's a game to save the animals

BY DIXIE REID
Chronicle Staff

This one is for the kids.

It's about a big word — extinction — which means that some kinds of animals are dying out, and if we don't protect those that remain, there will be no more of them — ever.

For a long time, grown-ups have been trying to save the "vanishing animals," and now more and more young folk are becoming interested in helping.

Realizing that interest and wanting to aid us in learning more about endangered species, some people at the Houston Zoo came up with Rescue!. It's a board game, similar to what you might find on the shelves of a toy store. There are a couple of differences: Rescue! is designed to be more than just fun — hopefully it will teach the players about what can be done to preserve wildlife. And, too, Rescue! is not for sale in any stores. It usually is seen only by fifth-graders whose school is visited by the traveling Zoomobile. Until now.

Rescue! is reprinted below for you. Cut it out and glue it to a piece of cardboard, to make it sturdier. On page 4 of the Leisure section, you will find a spinner and animal markers to use in playing the game. Cut out the spinner and tape it to a piece of thick cardboard; do the same with the arrow. Stick a pin through the dot on the arrow and then through the dot on the spinner. Cut out the six animal markers, representing the six endangered species of Texas, glue them to cardboard and tape a penny to the back to make them heavier.

And you can get out the crayons to color the game any the way you like.

The object of the game, as described by the creators of Rescue!, is to be the first player to get to the big map of Texas at the end of the trail.

To determine who goes first, each player spins and the

(See SOME ANIMALS, Page 4)



At left, who wants to touch an icky snake? Corde Hanzlik, a volunteer docent with the Houston Zoo's Zoomobile, shows the creature to some kids at Cooley Elementary School.

It's young folk to the Rescue! These fifth graders, left to right, Laura Moreno, Robert Dawson Jr. and Sammy Jackson, watch as their teacher, Mrs. Jerry Beck, explains the "vanishing animal" game.



Photos by Tom Colburn, Chronicle Staff

Some animals are protected by law

(From Page 1)

one with the highest number makes the first move. Each player takes turns by spinning the arrow and moving ahead the number of spaces to which the arrow points.

If you land on an outlined number, rather than a solid black number, you must follow the special instructions on the board.

After each player has chosen his marker, it might be interesting to learn something about the animals selected. The creators of Rescue! have prepared the following information about each of the endangered species in Texas:

Texas tortoise — Tortoises have been on the decline partly because they have not changed with time to fit the changes in the environment. Having started out with scaly skin, they are now the only land vertebrates who have part of their skeleton on the outside. They have become endangered because their shells are desired for tortoise shell products. Also because of their slow gait, many are killed by cars while crossing highways. In Texas, they are protected by law, and it is illegal to kill or injure them.

Prairie dog — Often wild animals and man's domesticated animals eat food from the same fields. Since man wants a big supply of food for his cattle, he tries to get rid of the wild animals. Ranchers and farmers use poisons to rid their lands of these pests. This has resulted in a decrease in the prairie dog population. Man has helped rescue prairie dogs by setting up reserves where they can live. These reserves are usually open to the public.

Attwater's prairie chicken — At one time this bird lived in great numbers along the coastal prairie from southwest Louisiana through Texas to the Mexican border. In 1965 there were about 750, but today if you cross those same prairies chances are you will not see this bird. Its habitat and breeding grounds were taken over by settlers who wanted to raise crops and graze cattle. Once hunted for food and sport, now it is against the law to shoot this bird.

Whooping crane — It is the tallest bird in North America. Named for its distinctive bugle-like call, these cranes once migrated in great numbers from their winter grounds on the Gulf of Mexico to their summer grounds on the Great Plains. During the westward movement of man in the last 20 years of the 19th century, the whooping cranes' breeding grounds were pushed further out. By 1940 there were only about 15 birds left. Land has been set aside for the whooping cranes which winter at Aransas National Wildlife Refuge near Corpus Christi, and they spend summers at Wood Buffalo Park in Alberta, Canada. Today there are more than 70 whoopers in the wild and two in captivity in zoos.

Brown pelican — Along the Texas coast, you once could watch many brown pelicans plunging from 30-60 feet in the air into the ocean to scoop fish. Of late, there have been few baby birds surviving. Poisons used to control pests are washed off the crops by rain and then drain into the oceans, which contaminates the pelicans' food, the fish. Although the pelican itself is not usually affected, pelican eggs lose their shell strength. The Houston Zoo breeds brown pelicans successfully.

Black-footed ferret — You probably will never see a black-footed ferret in your lifetime. Very little is known about this animal because it is the rarest mammal native to the U.S. Attempts to study the ferret have been frustrating because researchers have not found any specimens. It is believed the survival of the black-footed ferret is closely related to that of prairie dogs. Man has tried to protect ferrets by passing laws to protect them. Any that are found are usually released into reserves.

The game, Rescue!, came to be when Marion Riddell, interpretive services supervisor of the zoo's education department, recalled a similar game she had seen in graduate school, which concerned salmon going upstream to spawn, and was designed for the state of Washington.

It basically was intended to complement the work of the zoo docents aboard the Zoomobile, who take unusual animals into the classrooms of fifth graders in the city, to show them live creatures they may never have seen before.

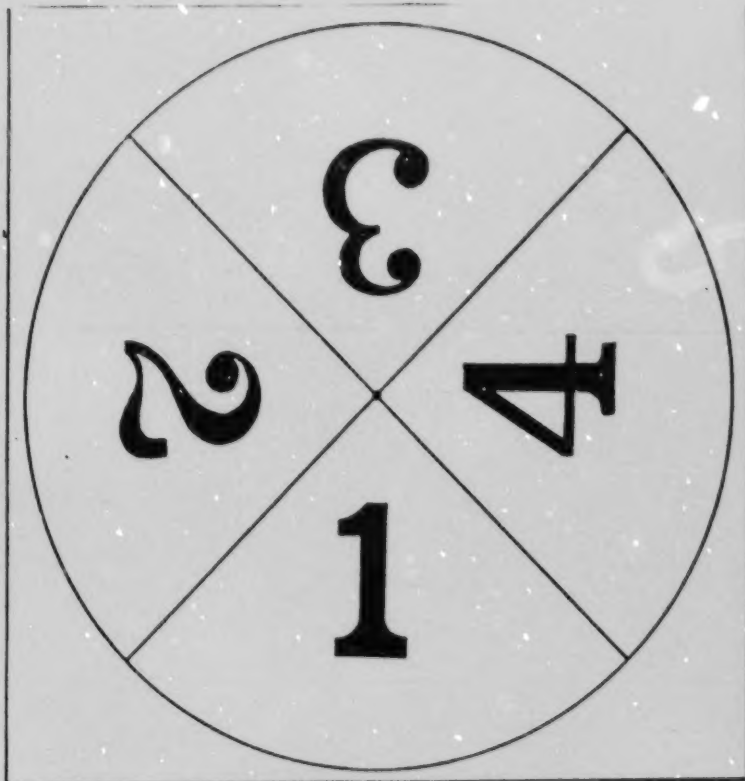
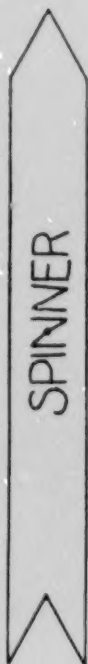
The game, they say, should be fun for anyone in the fourth through sixth grades.

It was Ms. Riddell who had the ideas and she was aided by Mundina Halbert, also of the zoo's staff, who designed and drew the game board. It was funded by the Assistance League of Houston.

What they hope to accomplish with Rescue!, says Ms. Riddell, is to inform children of the plight of vanishing animals and to mold their young attitudes, hoping that they will grow up being responsive to the needs of animals. And perhaps come to the Rescue! of creatures in need of help.

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Markers to use while playing Rescue! are, clockwise from top left: Texas tortoise, brown pelican, prairie dog, whooping crane, black-footed ferret,

Attwater's prairie chicken. Above right is the spinner and arrow, to cut out and paste on cardboard. You might want to color the game, too.

THE BALANCED AQUARIUM

Objectives

At the end of this activity the student should be able to

- . Recognize that a balance ecosystem needs producer and consumers
- . Organize and identify a balanced ecosystem
- . Identify the organization of food chains in nature

Materials

Nonfilamentous algae, such as Chlorella
Daphnia, the water flea
Eyedroppers
3 liters Knops solution (or very fertile pond water)
3 liters distilled water (or boiled tap water)
Green food coloring
70 baby food jars with covers
12 magnifying lenses or microscopes
12 marking pens or 60 paper labels
1 $\frac{1}{2}$ urethane

CAUTION: Do NOT order the algae or daphnia until you are ready to use them. The daphnia can be kept alive by adding a fresh, moist suspension of yeast to the culture until it is slightly milky. The culture must be kept at room temperature.

Daphnia may be found in fresh water ponds or lakes. Probably you will want to order a supply for one class.

How to Get Started

- . Why does water in a pond or stream turn green?
- . If you add soap or detergent to pond water, will it become more green?
- . If you add some fertilizer to pond water will it become more green?
- . Do animals thrive better in clear water?

For measuring the concentrations of algae solutions, prepare ten baby food jars in the following way: Use green food coloring to make about six ounces of deeply colored tap water solution. Fill one baby food jar with this solution and label it No. 1. Dilute the remaining solution by adding nine parts of tap water to the deeply colored solution to fill baby food jar No. 2. Repeat the

process for each remaining jar. There will be ten jars in a series of ten-fold dilutions. The last jar should appear almost colorless. Use these jars as a standard for describing the concentrations of algae in the jars.

What to Do in the Lab

Use four baby food jars. Fill the first jar with Knop's solution (a solution containing the salts found in fertilizers) or boiled pond water. Fill the second jar $\frac{3}{4}$ full with Knop's solution and add an eyedropper full of a rich green algae solution. Fill a third jar $\frac{3}{4}$ full with distilled water or boiled tap water. Add an eyedropper full of a rich green algae solution. Fill the fourth jar $\frac{3}{4}$ full with distilled or boiled pond water. Add an eyedropper full of daphnia solution to each jar. Cover the jars, label them, and place them in a safe place exposed to light. Put your name on the label.

The jars containing algae should be compared to the series of ten green standard solutions. By holding the jars next to each other before a window or light bulb, judge which jars are most similar in intensity of color. Classify your jars by color from 1 to 10. Record and date your numbers.

To count the daphnia, place a drop of the solution on a microscope slide. To avoid crushing the animals, place some bits of a broken coverslip around the drop. Then lay the coverslip over the drop. A magnifying lens will be sufficient to count the number of daphnia present in the drop. If one drop is too small, consistently use two or three drops. Record and date your numbers.

At two- or three-day intervals, make new classification of the color intensities of the algae solutions and new counts of the daphnia solution. Continue these counts for several weeks or until the counts reach a point of no further change. Make a chart to record the color intensities and the daphnia count in each jar.

Where to Go From Here

After preparing your five jars on the first day, write down your predictions about the changes in the quantities of algae and daphnia in the jars. Compare your predictions with your counts.

- . What is the value of having a jar which contains only Knop's solution?
- . Does the evidence support your prediction?
- . What would happen to the life in the jars if the temperature were raised or lowered?
- . Can you identify a chain of living organisms which feed upon smaller, lower organisms and serve as food for large organisms?

- . Can you describe this food chain beyond the organisms studied here?
- . Where does man exist in this chain?
- . What differences do you see between the complex systems as they occur in nature and the simplified systems you studied in this experiment?
- . What differences do you see between the complex systems as they occur in nature and the simplified systems you studied in this experiment?
- . What problems occur when man's agriculture greatly reduces the number of species in a region?

Other Things to Do

Extend the food chain by considering the effect of hydra on the daphnia. The food chain may be further extended by the addition of small fish such as minnows. This kind of study is done with an aquarium.

The concentration of algae may be measured by a student-made photometer. This instrument may consist of the following system: The baby food jar is in a dark box with a slot on each side of the jar. A light bulb shines through both slots and through the jar. A light meter on the opposite side of the jar from the bulb records the intensity of the light. Reading from this meter, which may be the ordinary kind used for cameras, will be much more accurate than the use of standard solutions.

If compound microscopes are available, the number of cells may be counted by using the same method as for counting red blood cells. The counting chamber is ruled glass slide with a 1mm. square center section divided into 25 squares. Each of these 25 squares is subdivided into 16 squares. When a coverslip is placed over the ruled area, the distance between the slide and the coverslip is 0.1mm. high.

Populations of plants and animals depend on energy that is readily available to them. The energy flows from the sun to green plants, to the herbivorous consumers, then on up the chain to the carnivorous consumers. Every food chain ends with the decomposers.

Chapter 8: Some Natural Changes

Advanced Preparations:

1. Prepare flats of grass for activity on p.175, Chapter 9.

Major Concepts to be taught:

Grouping of living things into communities and populations.
Development of the balance of nature
Development of ecological succession

Instructional Objectives:

The student should be able to -

- Describe the relationship between community and population.
- Describe a community that has a balance of nature and identify conditions that would upset this balance.
- Describe what happens during an ecological succession.

Assessment:

The student will:

- Define community. Observe and describe living and non-living factors in a community.
- Define population and explain how to study a population within a community.
- Observe and collect data and describe the community in which the student lives.
- Interpret graphs showing changes in a population.
- Define dynamic equilibrium and state how a balance of nature is maintained.
- Identify changes that occur during an ecological succession after a forest fire, landslide or other major ecological disasters destroy a community.
- Describe a climax community and locate its position in an ecological succession.

Materials:

Textbook: Exploring Living Things, pp.156-171
References: Teacher's Overview, pp.T45-49

Laboratory Experiments:

- Do It Yourself, Use Sampling, p.159
- Investigate: How can you study a dynamic equilibrium? p.163
- How can you observe ecological succession in pond water? p.167

Activity No. 12: Sampling Plant Populations, pp.41-44

Activity No. 13: Succession in an Aquatic Microcommunity,
pp.45-48

Films:

- M7414 - Communities of Living Things, 15 minutes
- 6099 - Life in a Pond, 11 minutes
- M2984 - Community, The, 11 minutes
- M6479 - Nature's Ever-Changing Communities, 14 minutes
- L7577 - Walk in the Forest, 28 minutes
- 7547 - Ecology of a Desert, 8 minutes
- 7069 - Ecology of a Swamp, 8 minutes
- 7548 - Ecology of Forests, 8 minutes
- 7054 - Ecology of Ponds, 8 minutes
- 7549 - Ecology of the Arctic, 11 minutes
- 7056 - Ecology of the Ocean, 8 minutes
- 7070 - Ecology of the Prairies, 8 minutes

Suggested Activities:

Summing Up, p.170

Checking Up: Vocabulary, p.170

Knowledge and Understanding, p.170

Concepts, p.171

Application and Critical Thinking, p.171

Doing More, Questions 1 and 2, p.171

Finding Out More, p.166

Do It Yourself, Find Out About Climax Vegetation, p.168

Teaching Strategy for p.162, T47

Teaching Strategy for p.164, T47

Teaching Strategy for p.168, T48

In Guide:

Typical Population Curve

Human Population Change

Investigation: How Many Beans? Population Exercise

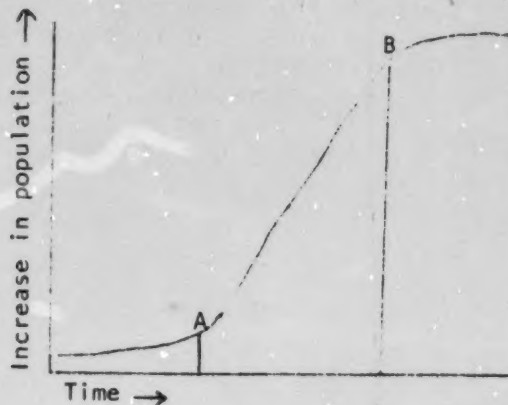
PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the relationship between community and population.	Read Chapter 8, pp.156-169 and orally discuss questions in margins. Do It Yourself, Use Sampling, p.159 (Metric measurement using a ruler) Activity No. 12: Sampling Plant Populations, pp.41-44 (Metric measurement using a meter stick) Doing More, No. 1, p.171 Doing More, No. 2, p.171 Show pictures or films of various types of communities. Discuss orally the differences in plant life, animal life, physical environment. List animal and plant populations for each community. Construct mobiles of animal population from different communities(desert, forest, jungle, polar, etc.) Prepare terrariums representing different communities: desert, meadow, forest, rotting log. Have students make a map of the school. Check to see how many students are in each classroom. Show how they are distributed at different times such as recess, classtime, or lunch time. With the help from an atlas students can color the overpopulated areas of the world on an outline map. Typical Population Curve activity, included in guide. Human Population Change activity, included in guide. Investigation: How Many Beans? Population Exercise, included in guide.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe a community that has a balance of nature and identify conditions that could upset this balance.	Investigate: How can you study a dynamic equilibrium? p.163. Teaching Strategy for p.162, Dynamic equilibrium discussion, T47. Teaching Strategy for p.164, People upset balance, T47. Have students observe results of over-population using guppies in an aquarium or fruit flies from the Oceanography Center. Graph days vs number of organisms present. Have students write a paragraph giving predictions based on these questions: What effect would the killing of all owls and hawks have upon the rodent population? What are some things that might happen should all owls and hawks be killed? Other situations using predator-prey groups or competitive organisms can be used. Research into the relationship of stress diseases such as heart disease, ulcers, etc., and overcrowded conditions.
Describe what happens during an ecological succession.	Investigate: How can you observe ecological succession in pond water? p.167. Find Out More, p.166. Do It Yourself, Find out about climax vegetation, p.168. Activity No. 13: Succession in an Aquatic Microcommunity, pp.45-48. Teaching Strategy for p.168, succession in the school yard, T48.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will	Using drawings or pictures students can illustrate factors that cause successions to begin. Illustrate the expected steps in each kind of succession. Be sure to include natural factors, as well as those involving activities of man.

Typical Population Curve

Populations of living things can be graphed. A typical population graph shows a curve as in the drawing below. This curve is common to all living things. There is a slow start, a rapid increase, then a leveling off.



The letters A and B have been added to identify certain places on the curve.

Interpretations based on the graph:

1. What was happening to the size of the population up to point A?
2. What happened to the population between points A and B?
3. What happened to the population after point B?
4. What types of things could happen to a population to cause it to stop growing?

Human Population Changes

Graph the changes in world population since 0 A.D. using the information in the following table.

POPULATION CHANGES

DATE	POPULATION (in millions)
0 A.D.	250
1650	500
1830	1,000
1930	2,000
1960	3,000
1970	3,600
1975	4,000
2000	7,500

Interpretations of the graph:

1. What does the graph tell you about population growth patterns on earth?
2. Has the human population leveled off yet?
3. What can you predict about population growth past the year 2000?
4. What can happen to earth if the population continues to grow from now on?

INVESTIGATION: HOW MANY BEANS? POPULATION EXERCISE

Sometimes a store owner will place a jar of beans or marbles in his display window and offer a prize to the person who can guess how many are in the jar. During this investigation you will estimate the number of beans in a paper cup. In doing so you will learn a method used by scientists to estimate the number of birds or trees in a forest preserve, deer in a national park, or fish in a lake.

Materials: (per team or per student)
Paper cup filled with white beans
Red beans, 10

Procedure:

1. Plan and carry out at least three procedures for estimating the number of beans without counting all of them. List your methods by number in your data book. Record the results in a chart.
2. A POPULATION-CENSUS METHOD is actually used by wildlife biologists who must estimate sizes of large populations. As applied to this problem, the method is one of adding ten red beans to the cup of white beans. (They must be well mixed.) Then twenty beans should contain about the same ratio of red beans/white beans that the cup of beans has. Say there are two red beans and eighteen white ones, a ratio of 2/18. You already know that there are ten red beans in the cup. From this information you can set up an equation:

$$\frac{2 \text{ red}}{18 \text{ white}} = \frac{10 \text{ red}}{X \text{ white}}$$

X stands for the total number of white beans. By solving the equation (finding the value of X) you will learn that the cup contains about 90 white beans—without having to count them.

Try this with your own beans and enter the results in your chart.

3. *Finally*, count the white beans one by one. Compare your actual count with your estimates.

Interpretation:

Which method of estimating did you find most accurate?
Which method could be used with the largest variety of populations?

To the Teacher:

We cannot predict what methods students may use for estimating the number of beans. Students should suggest their own ideas which may include the following:

1. Guess the number of beans without doing any counting.
2. Count out ten beans (or some even number); then estimate the number in the cup based on the ratio of the volume occupied by the ten to the total volume. (This is often used if beakers are used instead of paper cups.)
3. Weigh ten beans and replace them in the cup. Divide the weight by ten to determine the average weight of one bean. Now weigh ALL the beans. The total weight divided by the weight of one bean should approximately equal the number of beans in the cup.
4. Determine the average length of a bean and then determine the area they all occupy in a rectangular shape.

Student answers will vary depending on student ingenuity and luck.

Chapter 9: Conservation and Natural Resources

Advanced Preparation:

1. Get onions and elodea for experiments in Chapter 3
2. Order protists, amoeba, euglena and paramecium from Oceanograph Center for Chapter 10.
3. Order *Bacillus cereus* bacteria from Oceanography Center for Chapter 10, Activity No. 17.

Major Concepts to be taught:

Conservation of soil, air, and water.
Conservation of mineral resources.
Conservation of living things.

Instructional Objectives:

The student should be able to -

- Explain the importance of conservation of soil, air, and water.
- Describe how mineral resources can be conserved and recognize other possible sources of energy.
- Explain the importance of conserving living things.

Assessment:

The student will:

- To demonstrate the meaning of conservation and erosion, write a sentence using these two words.
- List ways to control erosion of soil.
- List ways to control air pollution.
- Diagram the water cycle.
- List ways to conserve water in the home.
- Identify four mineral fuels and state whether or not they are renewable or nonrenewable.
- Identify four alternative sources of energy people may be using in the future.
- Identify reasons to conserve forests.
- Identify reasons to conserve wildlife.
- Make predictions on possible results if man does not conserve natural resources.
- Recognize problems in conserving natural resources.

Materials:

Textbook: Exploring Living Things, pp.172-187
Reference: Teacher's Overview. pp.T49-53

Laboratory Experiments:

Do It Yourself, Study erosion, p.175

Activity No. 14: Removing an Impurity from water, pp.49-50

Activity No. 15: Obtaining Materials from Coal, pp.51-52

Films:

M3203 - Conserving Our Natural Resources, 18 minutes

5031 - Conserving Our Wildlife Today, 11 minutes

3996 - Conserving Our Mineral Resources, 11 minutes

M4448 - Everglades: Conserving a Balanced Community,
11 minutes

M5240 - Problems of Conservation: Our Natural Resources,
14 minutes

M5848 - To Save Our Environment: Conservation, 13 minutes

M7382 - Energy for the Future, 17 minutes

M7614 - Energy: Continuing Crisis, The, 14 minutes

L6670 - Say Goodbye, I, 26 minutes

L6671 - Say Goodbye, II, 26 minutes

Suggested Activities:

Summing Up, p.186

Checking Up: Vocabulary, p.186

Knowledge and Understanding, p.187

Concepts, p.187

Application and Critical Thinking, p.187

Doing More, Questions 1 and 2, p.187

Find Out More, p.176

Find Out More, p.179

Find Out More, p.184

Do It Yourself, Make a list, p.178

Do It Yourself, Find out about wildlife sanctuaries in your
area, p.184

Teaching Strategy for pp.174-175, T50

Teaching Strategy for p.175, T50

Teaching Strategy for p.175, T50

Teaching Strategy for pp.175-176, T50

Teaching Strategy for pp.177-178, T51

Teaching Strategy for p.180, T51

Teaching Strategy for p.182, T52

Teaching Strategy for pp.183-184, T53

Teaching Strategy for p.184, T53

Careers, p.185

Pros and Cons, pp.188-189

In guide:

The Nonrenewable Resources

Electric Users Activity

Checklist for Saving and Energy

Focus on Environmental Values

Arbor Day Puzzle Activity

Who Cares? Activity

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Explain the importance of conservation of soil, air and water.	Read Chapter 9, pp.172-185 and orally discuss questions in margin. Do It Yourself, Study Erosion, p.175. Teaching Strategy for pp.174-175, finding examples of erosion, T50. Teaching Strategy for p.175, activity showing use of plants to stop erosion, T50. Teaching Strategy for p.175, making model of farms, T50. Fill a large funnel with clay, another with sand, and a third with dry humus. Set up a support for the funnels and place a container under each. Pour equal amounts of water through each. After the water has run through the soils, measure the runoff water in ml. Form conclusions on which soil let water run through it most quickly and which retains the water and how this affects soil conservation. Find Out More, p.176. Teaching Strategy for pp.175-176, air pollution, T50. *Have students write down possible answers to these questions about water conservation: <u>I can save water when:</u> 1) I brush my teeth by _____ 2) I sprinkle the lawn by _____ 3) I wash dishes by _____ 4) I get a drink by _____ 5) I take a bath by _____ Activity No. 14: Removing an Impurity from Water, pp.49-50.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES				
The student will --	Make a drawing showing the water cycle. See description on p.146.				
Describe how mineral resources can be conserved and recognize other possible sources of energy.	Assume that all electrical power has been cut off in the community for a week. Have the students write a day by day account of the effects this would have on their lives and on the life of the community. Do It Yourself, Make a list, p.178. Activity No. 15: Obtaining Materials from Coal, pp.51-52. Teaching Strategy for pp.177-178, list of minerals, T51. Start a recycling project for paper and aluminum cans. (for locations of recycling businesses, see additional resources in front of guide.) Have students make lists of times and purposes in which electricity is used in one day. Ex: <table> <tr> <td><u>Use</u></td><td><u>Purpose</u></td></tr> <tr> <td>1. electric can opener</td><td>1. Open dog food can</td></tr> </table> Form conclusions to see if any of the uses could be eliminated to conserve energy. List areas around the home that students can help in conserving energy. Orally discuss ways to help conserve. Ex: 1) t.v.,lights, radio 7) insulation 2) stove and oven 8) doors and windows 3) dishwasher 4) clothes dryer 9) sink disposal 5) car 6) thermostat	<u>Use</u>	<u>Purpose</u>	1. electric can opener	1. Open dog food can
<u>Use</u>	<u>Purpose</u>				
1. electric can opener	1. Open dog food can				

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Students can read articles in recent periodicals that deal with energy problems. (Alaska pipelines, offshore oil, gas rationing, etc.) Write a statement on what it means to the students themselves. @Have students investigate one form of energy, its long-term strengths and weaknesses as an energy source and its effect on the local community, state, and nation. Give oral presentations. Ex: oil, coal, natural gas, oil shale, tar sands, nuclear fuels (uranium and thorium) tidal power, geothermal, solid waste, water power, solar energy, wind power. Teaching Strategy for p.180, demonstrate storage of solar heat, T51. Find Out More, p.179. The Nonrenewable Resources (Activity included in guide.) Electric Users Activity (included in guide) Checklist for Saving Energy (included in guide)
Explain the importance of conserving living things.	Find Out More, p.184. Do It Yourself, Find out about wildlife Sanctuaries in your area, p.184. Discuss Careers, Learning about Seals to Help Conserve Them, p.185. See Helps for Careers, T53. Read pp.188-189. Pros and Cons, Saving Animals. Form a panel discussion on this topic. Discuss importance of habitat preservation.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Discuss where money for wildlife preservation comes from. Focus on Environmental Values sheet (included in guide) For students that are interested, pass out listing of conservation and environmental organizations. Teaching Strategy for p.182, Conserving forests and recycling, T52. Teaching Strategy for pp.183-184, State's Game laws, T53. Teaching Strategy for p.184, Bird feeder T53. Doing More, Question 2, p.187. Arbor Day Puzzle Activity (included in guide) Who Cares? Activity (included in guide)

THE NONRENEWABLE RESOURCES

This activity may be in the form of a debate or class discussion on the wisdom of using up a nonrenewable resources such as petroleum for economic and convenience reasons.

Objectives

At the end of this activity the student should be able to

- . Cite at least five reasons man should not continue to use petroleum as a fuel and should spend time and money to re-search the use of substitute energy sources
- . Cite at least five reasons man should continue to use available petroleum as a fuel until normal technological progress based upon need provides a substitute energy source
- . List several alternate solutions to the need for increased amounts of petroleum fuels to satisfy man's requirements for energy
- . Collect data to support either side of the debate
- . Analyze data to determine their significance in relation to the question
- . Construct graphs and other displays of information (pictures, slides, pamphlets, and reports) to illustrate the presentation
- . Determine the major sources of energy in the future and compare each with the advantages offered by burning petroleum products
- . Attempt to predict the results of continued use of petroleum products
- . Design a system to evaluate the results of the debate
- . Construct graphs and other displays of information (slide pictures, transparencies, posters) and write reports to illustrate the presentation
- . Determine the principal ways pollution could be controlled and compare these with the environmental benefits of limiting the earth's population

Major Issues

- . Is the proposed course of action absolutely necessary to the solution of the environmental pollution problem?
- . How effectively will the proposal remedy the existing state of affairs, such as air pollution, water pollution, depletion of nonrenewable resources, crime, famine, and decreasing availability of energy resources?
- . Is the proposal feasible and desirable?

Evaluation Questions

- . What were the major points made by each side?
- . How did each point withstand the arguments of the opposition?
- . What related problems were introduced which will require further investigation?
- . Were there any emotional rather than objective presentations?
- . Were the facts and evidence distorted in either of the presentations?
- . Were loaded words or questions used?
- . Was questionable evidence used in the presentation?

Source of Materials

Superintendent of Documents, U.S. Government Printing Office,
Washington, D.C. 20402

Procedure

Conduct a debate in class on the following topic:

RESOLVED: That man should expend all necessary resources to develop a substitute energy source for fossil fuels (petroleum) in order to conserve this nonrenewable resource for lubrication, drugs, and chemical products.

Major Issues

- . Is the proposed course of action necessary?
- . Will the proposal remedy the existing state of affairs such as pollution and decreasing supply of petroleum?
- . Is the proposal feasible or desirable?

Evaluation Questions

- . What were the major points made by each side?
- . How did each point withstand the arguments of the opposition?
- . What related problems were introduced which will bear further investigation?
- . Were there any emotional rather than objective presentations?
- . Were facts and evidence distorted?
- . Were loaded words or question-begging terms used?
- . Was questionable evidence used in the presentation?

Resources

A resource packet is available from the Oil Information Committee of the Texas Mid-Continent Oil and Gas Association, 2920 Southland Center, Dallas, Texas 75201

ELECTRIC USERS

(Figure your electric use - where can you save energy?)

Energy User	Power (Watts)	Time Used per day (hours)	Energy consumed per day (Watts X hours)
Air cleaner	50		
Air conditioner (room)	1,566		
Bed Covering	117		
Blender	386		
Broiler	1,436		
Carving Knife	92		
Clock	2		
Clothes Dryer	4,856		
Coffee Maker	894		
Deep Fryer	1,448		
Dehumidifier	257		
Dishwasher	1,201		
Egg Cooker	516		
Fan (attic)	370		
Fan (circulating)	88		
Fan (window)	200		
Floor Polisher	305		
Freezer (15 cu. ft.)	341		
Freezer frostless (15 cu. ft.)	440		
Frying Pan	1,196		
Germicidal Lamp	20		
Hair Dryer	381		
Heater (portable)	1,322		
Heater (infrared)	250		

Energy User	Power (Watts)	Time Used per day (hours)	Energy consumed per day (Watts X hours)
Heating pad	65		
Hot plate	1,257		
Humidifier	177		
Iron (hand)	1,008		
Mixer	127		
Oven, Microwave	1,500		
Oven, Self-clean- ing	4,800		
Radio	71		
Radio/record player	109		
Range	12,200		
Range, Self-clean- ing	12,200		
Refrigerator/Freez- er (14 cu. ft.)	326		
Refrigerator/Freez- er Frostless (14 cu. ft.)	615		
Roaster	1,333		
Sandwich grill	1,161		
Sewing machine	75		
Shaver	14		
Sun lamp	279		
Television (black and white) tube type	160		
Television (black and white) solid state	55		
Television (color) tube type	300		
Television (color) partial solid state	200		
Toaster	1,146		

<u>Energy User</u>	<u>Power (Watts)</u>	<u>Time Used per day (hours)</u>	<u>Energy consumed per day (Watts X hours)</u>
Toothbrush	7		
Trash Compactor	400		
Vacuum Cleaner	630		
Vibrator	40		
Waffle Iron	1,116		
Washing Machine (automatic)	512		
Washing Machine (manual)	286		
Waste Disposal	445		
Water heater (standard)	2,475		
Water heater (quick-recovery)	4,474		

CHECKLIST FOR SAVING ENERGY

The following lists of energy conservation ideas has been taken from recently published sources pertaining to the current energy shortage.

Indicate which group(s) could assume responsibility for accomplishing these tasks.

- (1) Children
- (2) School
- (3) All People

HEATING AND COOLING

	Children	School	All people
Insulate all heating, piping and ducts exposed.			
In winter, set thermostats at 68 degrees during the day-time, 65 degrees at night.			
Eliminate use of air conditioning until room temperature is above 78 degrees.			
Avoid blocking heating vents with draperies or furniture.			
Close the damper on your fireplace chimney when not in use.			
Keep doors to corridor closed, (except when thermostat is in corridor).			
Turn off and/or close all heat/air conditioning vents in unoccupied rooms.			
Do not heat hallways or storage rooms.			
In winter, keep draperies open during the daytime to utilize solar heat.			
Put draperies, shades, or blinds at all windows.			
Keep heating and cooling vents free from obstructions.			
	147	160	

Children	School	All people

In winter, use an extra blanket at night instead of additional heat.

Wear more clothing in cold weather.

UTILITIES

Use cold or warm water, rather than hot water, whenever possible.

Wash only full loads in dishwasher and washing machine.

Use less water for showers and baths.

Don't leave water running while brushing teeth.

Keep a jar of water in the refrigerator so that you don't have to run tap water waiting for it to get cool.

Hang clothes outside to dry whenever possible.

Reduce bulb wattage where practical.

Keep television, radios, and stereos off when not in use.

Keep lights off when room is not in use.

Turn off lights whenever natural lighting is suitable.

Eliminate yard lights. Turn on porch lights only when expecting visitors.

MAINTENANCE

Replace broken windows.

See that doors and windows
fit frames properly.

Install weather-stripping
around all windows and
doors.

Repair leaking features.

Clean lighting fixtures,
lamps, reflectors, and
shades.

Walls and ceilings should be washed periodically and repainted as necessary.

Regularly replace air conditioner and heater filters.

TRANSPORTATION

Reduce Speed

Maintain a steady highway speed in harmony with traffic conditions and posted speed limits.

Reduce idling.

Drive in a car pool.

Use public transportation.

Ride your bike.

[illegible]

Children	School	All people
		163 150

JUST SCHOOL

Schedule all school meeting during the daylight hours.

Schedule extracurricular activities and community activities for daylight hours.

Rearrange seating to keep people as far from exterior walls and windows as possible.

Maintain halls, gyms, and auditoriums at a lower temperature (65 degrees). (In winter).

Reduce lighting in gyms, locker rooms, shower rooms, shops, libraries and general work areas by turning on one row of lights at a time until desired level of lighting is reached.

OTHER EFFORTS

Write your Congressman;
make your feelings known
on bills affecting the
energy problem.

Invite qualified speaker
to address your class on
energy concerns.

Make local news media aware of your interest in adequate coverage of energy related news.

FOCUS ON ENVIRONMENTAL VALUES



PREDATOR CONTROL

If you need more space for any of your answers to the following questions, feel free to continue on the back. (Please number your answers if you do.)

1. What prejudices does this cartoonist seem to have?
2. Are they the same as yours? Explain please.
3. What people would agree with you?
4. Who would disagree with you?
5. What is factual about this picture?
6. What is opinion (or fiction) about this picture?

WHO CARES ?

B.C.

—By JOHNNY HART



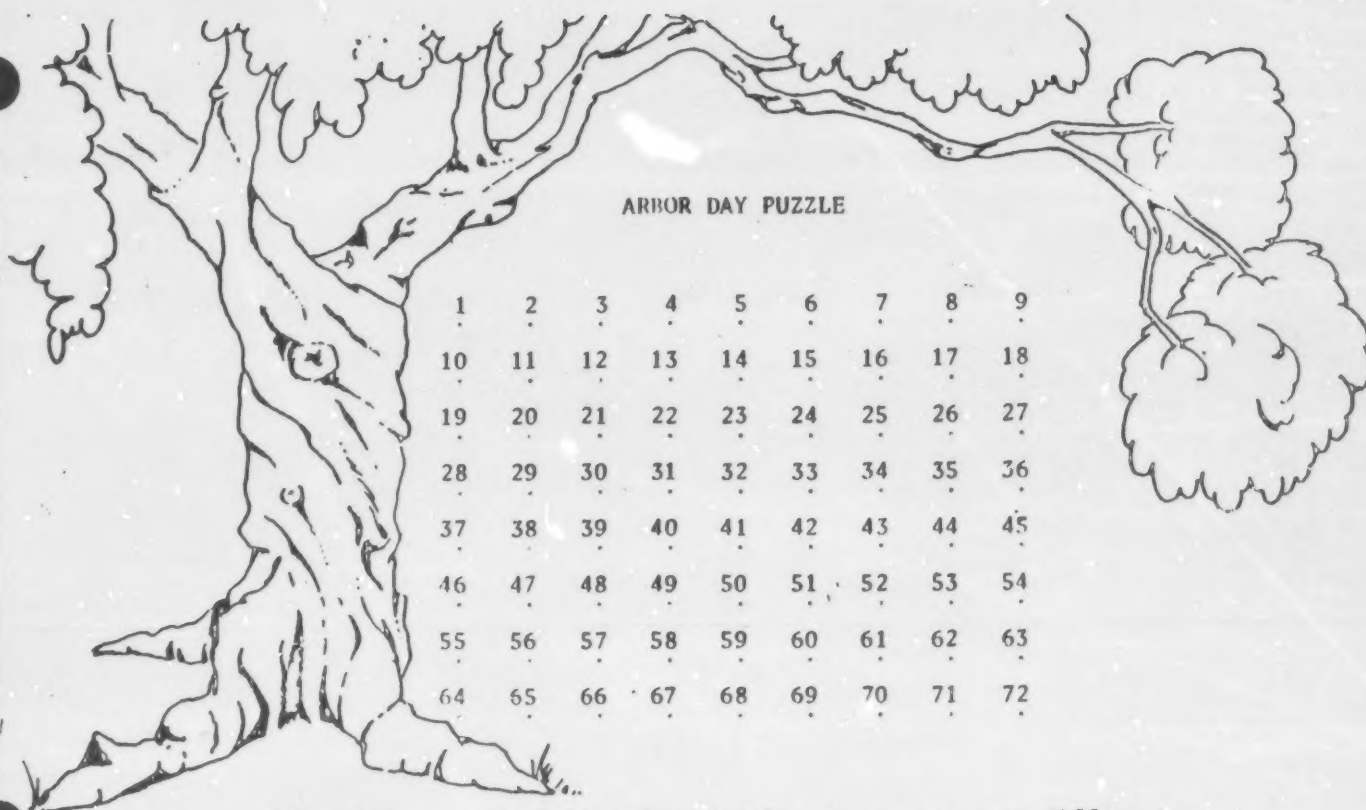
FOULING MOTHER NATURE

Many years ago several well-intentioned citizens decided to preserve the dinosaur. The society Save Our Dinosaurs (SOD) was founded. Another environmental group, Dinosaurs Are Beautiful (DAB), formed chapters in every village. Before long these dumb, cumbersome creatures flourished throughout the land. By the end of the 20th century they were everywhere, trampling gardens, bumping into parked cars, and so forth, thanks to top billing on the list of endangered species.

This, of course, is fiction. But nature has wiped out a number of species for reasons of her own, and one can only wonder if some of our so-called endangered animals aren't really meant to be endangered. Possibly a few objectionable creatures should be removed from the list. As someone remarked sarcastically, maybe alligators are intended to shoe human feet. Do we truly know what's best? *

* from The Houston Post, August 20, 1975

1. What is fact about this report?
2. What is made up in this story?
3. Do you agree with the author? Why, or why not?
4. Do you think many people feel the same as you do about this issue?



ARBOR DAY PUZZLE

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72

Arbor Day, a special time for planting trees, comes at different seasons in different sections of the country. In Texas, Arbor Day is observed on the third Friday in January.

Here are some questions about trees. If you answer them correctly and follow the directions, you can draw a tree in the space above. START AT DOT NUMBER 67. If the answer to the first question is Yes, go to Dot 68. If the answer is No, go to Dot 58. Follow this plan for each question.

	YES	NO
Do acorns grow on sassafras trees?	68	58
Is wood used in making paper?	55	66
Is Paul Bunyan the hero of stories about lumbering?	39	46
Are cedar trees mentioned in the Bible?	38	40
Will a nail, driven into a trunk of a tree, be at the same height in 10 years?	22	29
Is the pecan the state tree of Texas?	21	31
Do you find pineapples on pine trees?	12	5
Is the cedar tree evergreen?	25	14
Does cotton grow on cottonwood trees?	16	24
Does rubber come from trees?	44	33
Is Arbor Day observed in February in Texas?	35	43
Does cedar oil come from pine trees?	52	63
Do dates grow on palm trees?	65	54
Are deciduous trees those which drop their leaves in the fall?	59	51

UNIT 3

CELLS AND PROTISTS: MICROSCOPIC STUDY

Time Allotment:
12 days for entire unit

Chapter 3: Cells: Small Packages of Life

Advanced Preparations:

1. Collect pond water for Chapter 10.
2. Prepare nutrient agar petri dishes for Chapter 10.
3. Set up hay infusion.

Major Concepts to be taught:

Development of cell theory
Development of cell structure and function
Osmosis and Diffusion
Mitosis: cell division

Instructional Objectives:

- The student should be able to -
- Relate scientists to their contribution in cellular study.
 - Identify the main parts of the cell and the function of the parts.
 - Compare the similarities and differences of animal and plant cells.
 - Describe osmosis and diffusion.
 - State the purpose of mitosis and demonstrate how a cell divides by the stages of mitosis.

Assessment:

- The student will:
- Explain the cell theory.
 - Associate the contributions of Robert Hooke, Theodore Schwann, and Matthias Schleiden to the cell theory.
 - *E*Label a cell drawing to show the cell membrane, nuclear membrane, nucleus, cytoplasm and vacuole.
 - Identify the functions of the parts of a cell.
 - Arrange the stages of mitosis (cell division) in the proper order.
 - *E*Compare a cell from an animal with one from a plant, giving at least three likenesses and two differences.
 - Define and identify an example of each: diffusion, osmosis.
 - Observe cells using a microscope.

Materials:

Textbook: Exploring Living Things, pp.40-57

References: Teacher's Overview, pp. T19-20

Laboratory Experiments:

Investigate: What do onion skin cells and their parts look like under a microscope? p.43.

Investigate: What happens during osmosis? p.50

Activity No. 4: Animal cells and Plant cells, pp.15-18.

Activity Booklet

Activity No. 5: Osmosis through an Animal Membrane, pp.19-20

Activity Booklet

Activity No. 6: Osmosis through a Plant Membrane, pp.21-22

Activity Booklet

Activity No. 7: The Rate of Osmosis, pp.23-26

Activity Booklet

Films:

M3072 - Cell Biology: Structure and Composition, 14 minutes

M6013 - Nature of Life: Cells, 14 minutes

M7747 - Cell: Structural Unit of Life, 11 minutes

2743 - Diffusion and Osmosis, 11 minutes

L2998 - Mitosis, 23 minutes

Suggested Activities:

Summing Up, p.38

Checking Up: Vocabulary, p.38

Knowledge and Understanding, p.39

Concepts, p.39

Application and Critical Thinking, p.39

Doing More, Questions 1 and 2, p.39

Find Out More, p.41

Find Out More, p.52

Find Out More, p.54

Do It Yourself, Observe evidence for moving molecules, p.47

Do It Yourself, Examine slides showing mitosis, p.56

Teaching Strategy for pp.42-46, T20

Teaching Strategy for pp.47-48, T21

Teaching Strategy for pp.48-49, T21

Teaching Strategy for p.53, T22-23

Teaching Strategy for pp.54-56, T23

Cell Division Drawing

Cell Drawing

Inquiry Demonstration: Cell Volume and Diffusion

In Guide:

Cell Division Drawing

Cell Drawing

Inquiry Demonstration: Cell Volume and Diffusion

Functions of the Cell Parts

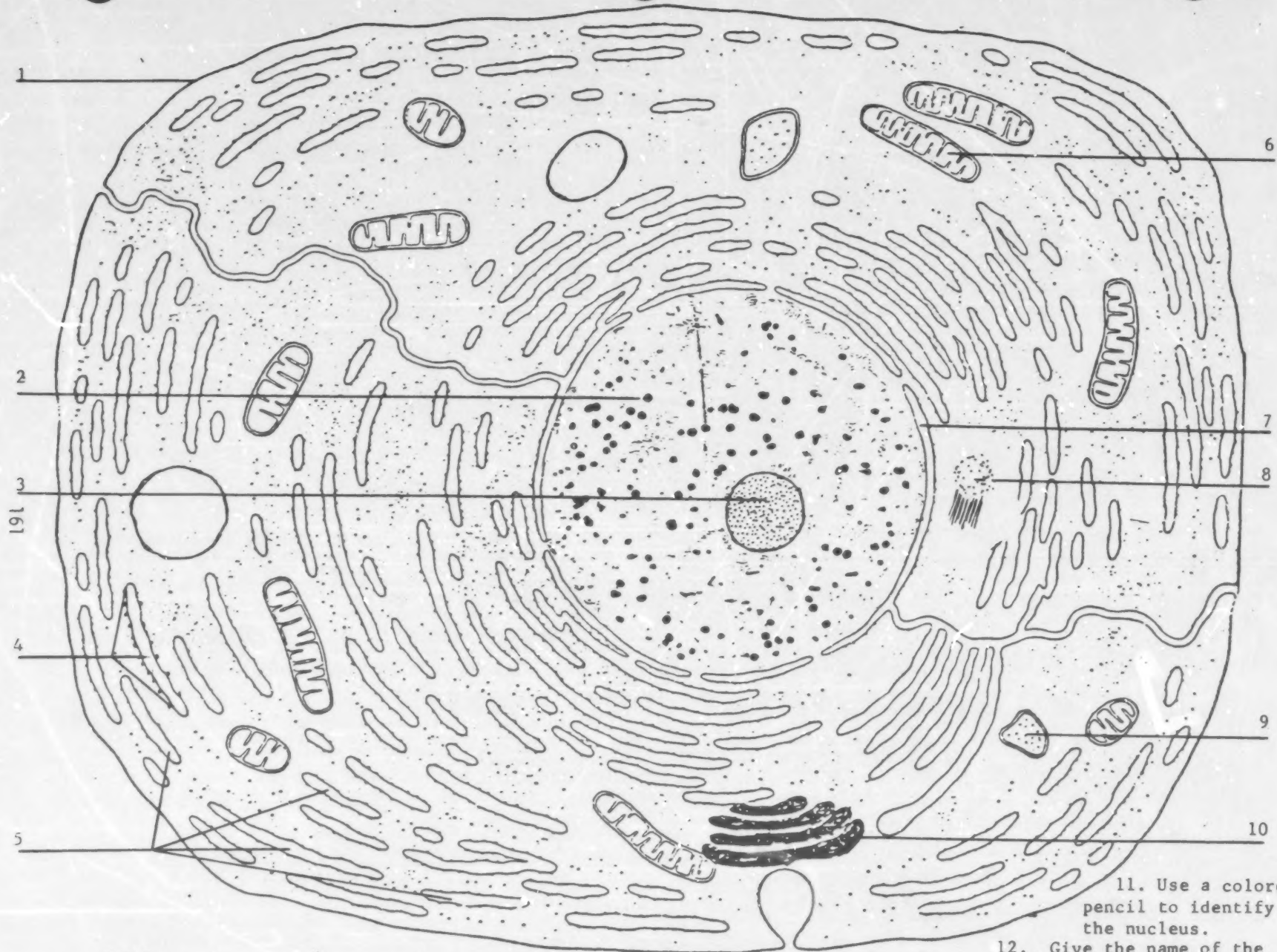
The Parts of A Cell and Their Functions

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will :-	
Relate scientists to their contribution in cellular study.	Using the lives of Hooke, Schwann, and Schleiden, students could give short skits on these men. Individual library work would have to precede this. Teaching Strategy for p.53, Research on Scientists, T22-23
Identify the main parts of the cell and the function of the parts.	Read over Chapter 3 as a class project and go over the questions in the margin as classroom discussion. Use an overhead projector and show the parts of a cell and give their function. E*Have the students draw, label and color the parts and write a function for each. For extra credit have students make a cake and decorate the top with candy and cake decorations in the form of a cell diagram with all the parts of the cell. Eat in class after discussion. Make copies of "The Parts Of A Cell and Their Functions" and go over as a class discussion. Have students make copies. A fun lab is the construction of a three dimensional cell. For materials the students can use styrofoam, baggies, aluminum foil, noodles, macaroni, beans, buttons, yarn, or anything from home. Another fun game is to make a zig-zag puzzle of the cell out of cardboard. Find Out More, p.41. E*Cell Part Game. Teaching Strategy for pp.42-46 T20.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Provide for the students electron microscope pictures of different cells. Students can point out structures and their functions. Doing More, Question No 1, p.59. Find Out More, p.52.
Compare the similarities and differences of animal and plant cells.	Investigate: What do onion-skin cells and their parts look like under a microscope, p.43. E*List separately the major cell parts for a plant cell and animal cell. Challenge the student to decide why the cell parts can be alike or different. Example: Both cells have a nucleus and are therefore living; a plant has chloroplasts, is green, and manufactures its own food. E*Activity No. 4: Animal Cells and Plant Cells, pp.15-18. Research and report on the composition of the cell wall. How does the cell wall originate? Are all cell walls composed of cellulose? Spread tomato pulp out in a drop of water on a clean slide. Add a cover slip and observe the tomato cells under low power. Locate the cell wall, vacuole, and nucleus. Locate the pigment granules which give the tomato its color. Draw and label what is observed. Use the microprojector to point out different types of cells in plant and animal cross-sections and their different functions. Teaching Strategy for p.45, Cell wall discussion, top of T21.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe osmosis and diffusion.	*Do It Yourself: Observe evidence of moving molecules. (to illustrate diffusion) p.47. Investigate: What happens during osmosis? p.50. Activity No. 6: Osmosis through a Plant Membrane, pp.21-22. Activity No. 7: The Rate of Osmosis, pp.23-26, Activity Booklet. Teaching Strategy for pp.47-48, Diffusion demonstration, T21. Teaching Strategy for pp.48-49, Osmosis activity, T21. Doing More, No. 2, p.59. To demonstrate osmosis, have students place a piece of celery and a piece of potato in a beaker of distilled water and in a beaker of salt solution. Observe the next day. Compare the results, and form conclusions. (How does salt affect osmosis in cells?) Observe osmosis using a microscope: first observe elodea using a microscope, then add two drops of salt water next to edge of cover slip (use a piece of paper towel at other edge of cover slip to draw salt water under the cover slip.) Make observations, compare results, and form conclusions. @Research and report on active transport. *Have students collect substances that demonstrate diffusion (perfumes, colognes, etc.)

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- State the purpose of mitosis and demonstrate how cells divide by the stages of mitosis.	Have students copy diagrams of the stages of mitosis on overhead projector (interphase, prophase, metaphase, anaphase, and telophase), pp.54-56. Do It Yourself: Examine slides showing mitosis, p.56. Find Out More, p.54. Teaching Strategy for pp.54-56, Plant cell mitosis activity, T23. Mitosis Game. Have each student draw each stage of mitosis on a separate index card or paper. Mix the cards. Work in pairs. Time each other to see how long it takes to arrange the cards correctly. Use insulated electric wire to show dynamics of splitting of chromosomes. Separate, tie a piece of string to each piece, slip a band around the cord, and pull the strings slowly apart. Students can model colored clay chromosomes to help understand mitosis. On a sheet of paper draw circles to represent cells. Place clay chromosomes in cells as mitosis proceeds. Another way for students to demonstrate mitosis is to fill petri dish with corn syrup, sprinkle iron filings into center. Use two magnets to duplicate the stages of mitosis.

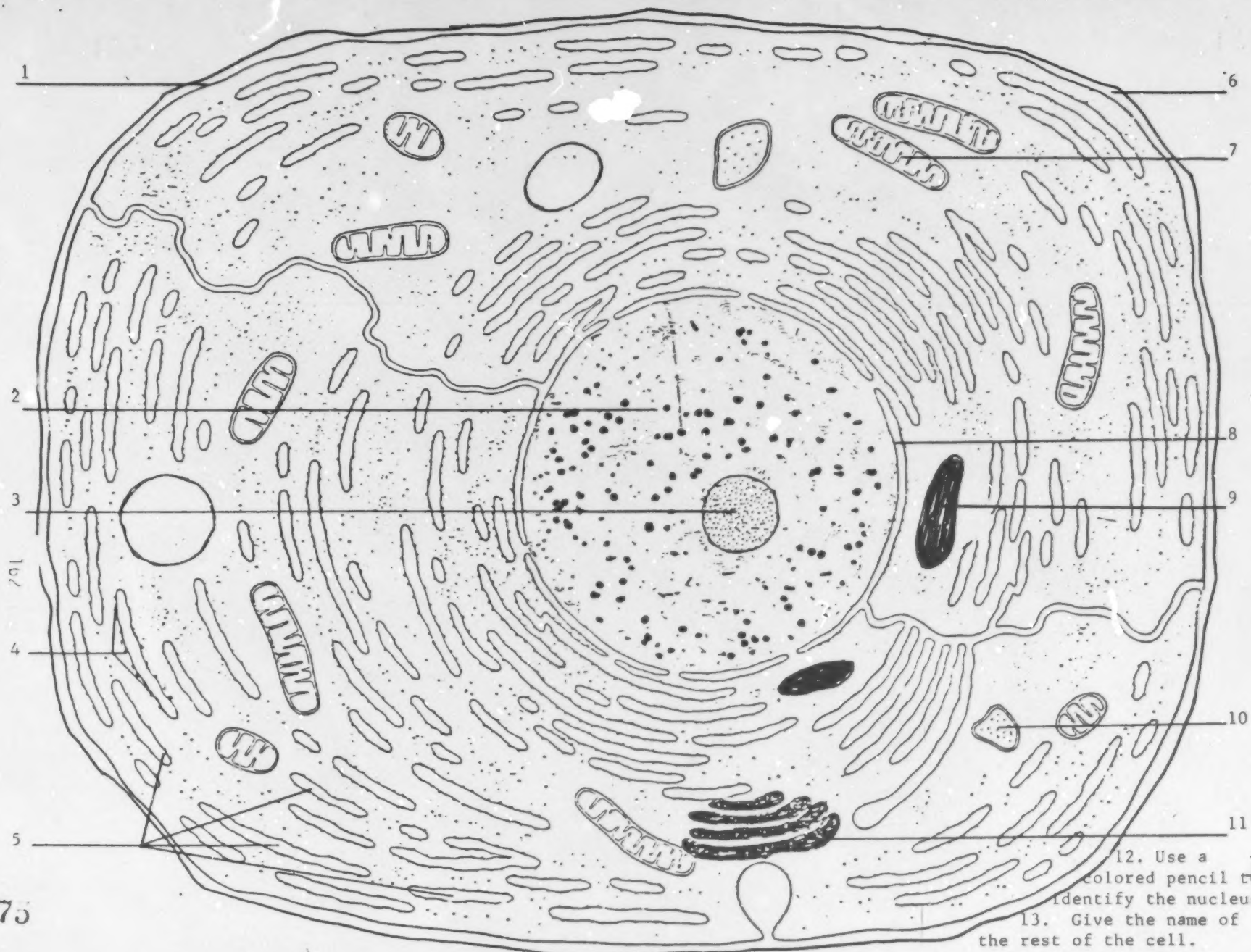


173

ANIMAL CELL

11. Use a colored pencil to identify the nucleus.
12. Give the name of the rest of the cell.

174



175

PLANT CELL

12. Use a colored pencil to identify the nucleus.
13. Give the name of the rest of the cell.

176

ANIMAL CELL

Key

1. Cell membrane
2. Chromatin
3. Nucleolus
4. Ribosomes on the endoplasmic reticulum
5. Canals of the endoplasmic reticulum
6. Mitochondria
7. Nuclear membrane
8. Centrosome
9. Lyosome
10. Golgi bodies
11. (All the area inside the nuclear membrane should be colored.)
12. Cytoplasm

PLANT CELL

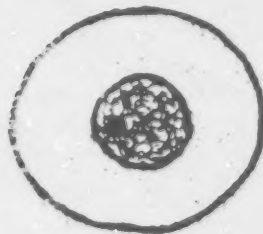
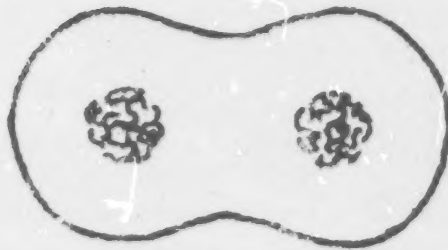
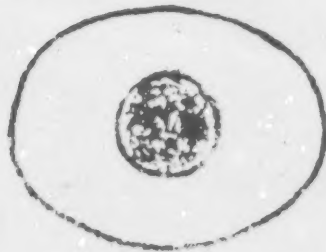
Key

1. Cell membrane
2. Chromatin
3. Nucleolus
4. Ribosomes on the endoplasmic reticulum
5. Canals of the endoplasmic reticulum
6. Cell wall
7. Mitochondria
8. Nuclear membrane
9. Chloroplast
10. Lyosome
11. Golgi Bodies
12. (All the area inside the nuclear membrane should be colored.)
13. Cytoplasm

FUNCTIONS OF THE CELL PARTS

- CELL MEMBRANE:** The outer surface of the cell protoplasm or cytoplasm. Its job or function is to regulate the passage of liquids and gases into and out of the cell.
- CYTOPLASM:** The protoplasm (other than the nucleus) that is in all plant and animal cells. Its function is to carry on all the activities of metabolism (the building up and breaking down of protoplasm)
- NUCLEUS:** A definite structure within the cytoplasm of every cell. Its function is to control the activities of the cell, especially the function of cell division, either to make a group of like cells or tissue or to reproduce the species.
- CHROMATIN GRANULES:** Within the nucleus. Their function is extremely vital. They determine the inheritance or heredity of characteristics from one generation to another. (chromosomes)
- NUCLEAR MEMBRANE:** The outer boundary of the nucleus; separates the nucleus from the cytoplasm. It determines what will enter and leave the nucleus.
- NUCLEOLUS:** One or more dense bodies within the nucleus. Storage center for RNA molecules.
- VACUOLES:** "Spaces" within the cytoplasm which store water and necessary materials dissolved in water (cell sap in plants) and collect liquid wastes (in animal cells).
- Structures found only in plant and some protist cells, not found in animal cells:
- CELL WALL:** A hard, outer "shell-like" substance called cellulose which surrounds the soft cell membrane. Its function is to protect the cell and give it stiffening and support.
- CHLOROPLAST:** The green color bearing bodies or particles in the cytoplasm. The green color is known as chlorophyll. This pigment performs the vital function of food manufacturing within the green plant.
- Structure found only in animal and some protist cells, not found in plant cells:
- CENTROSOME:** Aids cell only during cell division.

CELL DIVISION



165

179

INQUIRY DEMONSTRATION: CELL VOLUME AND DIFFUSION

A difficult concept to convey is the importance of the relationship between surface area and volume. This relationship may be involved in setting size limits that cells reach, and it certainly is involved in the difficulties that the multicellular animal must solve. The following teacher demonstration is designed to present a visible way the relationship between surface area and volume may be illustrated.

Materials:

Agar (non-nutrient)
Household ammonia
1% phenolphthalein
Baby-food jars
50 or 100 ml beakers
Molds: 8-inch piece of dialysis tubing
Various sizes of prescription bottles
2 one-gallon jars, preferable with lids (Aluminum foil or plastic wrap may be used as lids.)

Procedure:

1. Add 25 grams of agar to 1000 ml water and bring to a boil. As the agar cools, add 4 ml of 1% phenolphthalein solution and stir. (If the mixture is pink, slowly add drops of dilute HCL and stir until color disappears.)
2. Pour the mixture into each of the molds and allow to cool and gel. Molds may be stored in a cool place or refrigerator, but not frozen.
3. When it is time for the demonstration, place the two large jars (diffusion chambers) where they can be seen by the students. In the bottom of each chamber place a baby-food jar half-filled with household ammonia. Place two small cores in one diffusion chamber and one of the larger cores in the second chamber. Cover the chambers tightly. (It is very effective to have the chambers already set up ready to receive the cores before starting the demonstration.)
4. Answer questions the students may have about what is in the various materials; do not give information about what might result. Ask them to observe what happens.
5. After a few minutes (5-10) take the cores out of the jars and cut two slices from one end of each core and discard it. Then cut another thin slice and place on white paper or on the overhead for observation. Have the students determine and record the width of the pink zone of each core. (A clear flat plastic ruler is useful on the overhead. Place the agar on a transparent plastic sheet.)
6. Place the cores back in the ammonia chambers for a few more minutes. Repeat procedure 5. Replace the cores and remove them again a few minutes later. Be sure the students record the increases in pink area of the cores.

Interpretations:

Ask students to imagine that the sections represent cells and that the pink color represents food or oxygen diffusion into the cells. Ask what the demonstration seems to indicate about cells. Ask how the time of diffusion could be increased in the larger cell.

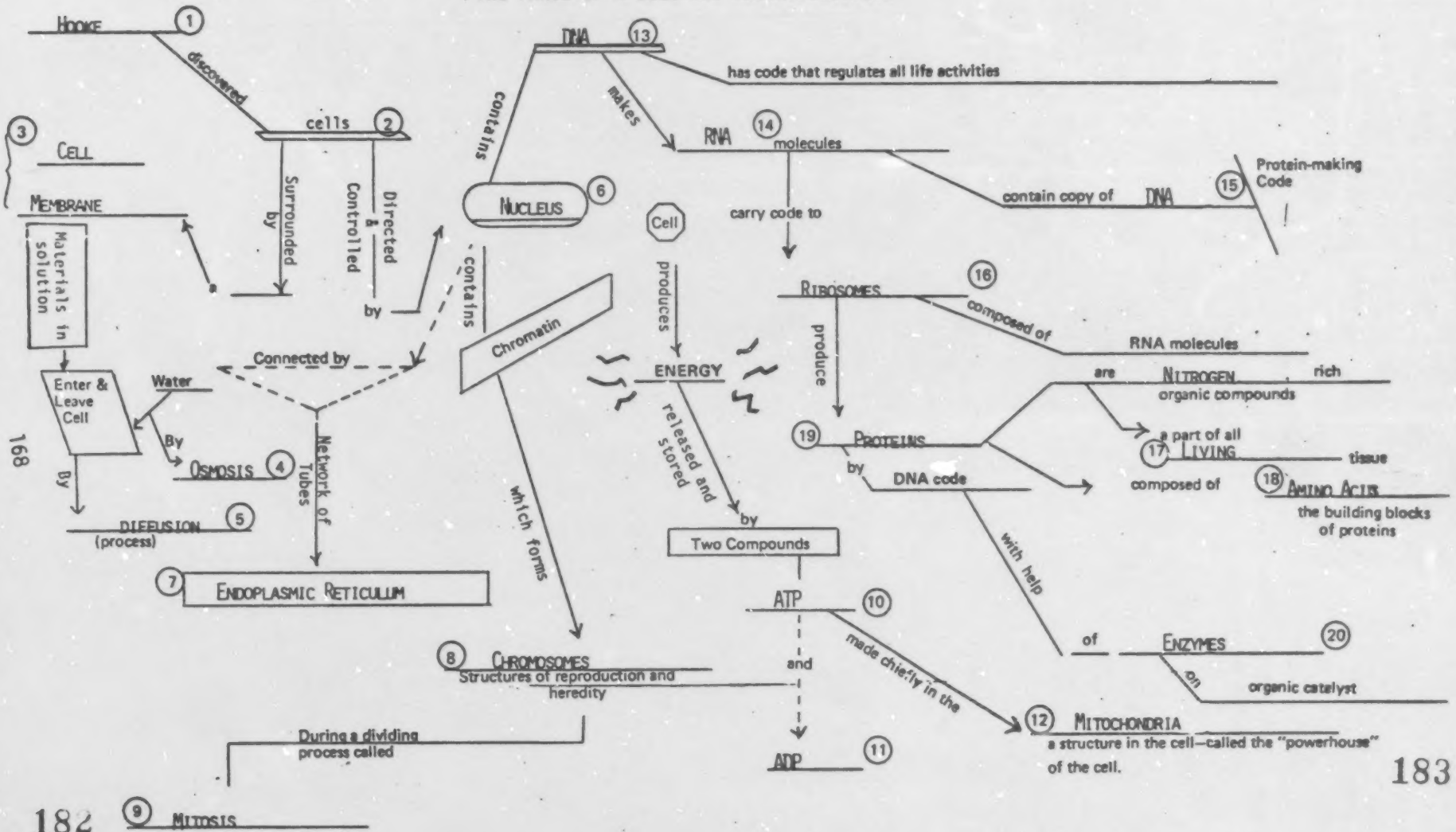
Students should see that—

1. The rate at which diffusion occurs does not appear to be influenced by cell size. Diffusion is constant.
2. The larger cell is not going to get food in its center during the same period of time that the smaller cell does.
3. The relationship between surface area and volume may limit size of cells.

Ask:

If the small intestine is just a hollow tube, how could it be changed in structure to increase the time of absorption of foods into the body. (Students will reply: by increasing the surface area. Ask them to be specific in their answers—to give specific examples of how this could be accomplished.)

THE PARTS OF A CELL AND THEIR FUNCTIONS



Chapter 10: Protists

Advanced Preparations:

1. Collect and order samples of the sponges, hydra, planaria, earthworms, starfish, mollusks, arthropods, amphibians, reptiles and birds to illustrate new unit on animals. Preserved specimens and charts may be used. Check your laboratory for items.
2. Order from the Oceanography Center hydra for Chapter 15, demonstration order of an earthworm for Chapter 16, and snails, brine shrimp, daphnia and drosophila for Chapter 17.

Major Concepts to be taught:

Characteristics of protists
Classification of bacteria
Bacteria cultures and staining
Identify and name the protists
Development of structural differences in protists

Instructional Objectives:

The student should be able to -

Describe the characteristics of protists.
Differentiate by recognizing and comparing kinds of bacteria.
Prepare bacteria cultures and recognize staining procedures.
Compare and contrast the different examples of protists presented.

Assessments:

The student will:

- E*Identify the distinguishing characteristics of protists and give the names of two protists.
- *E*Compare animal cells and plant cells, giving at least three likenesses and two differences.
- E Explain what bacteria are and where they are found.
- E*Label drawings of the three kinds of bacteria: coccus, bacillus, and spirillum.
Prepare cultures of organisms found on the hands, from their mouths, in the air, or tooth tartar.
- E*List two good and two harmful effects of bacteria.
Match the following terms with their meaning: culture, media, sterilization, inoculation, agar, anaerobic bacteria, aerobic bacteria, flagellum, cilia, pseudopodia, micro-organism.

Observe protists in a microscope and label drawings of amoeba, paramecium, and euglena.
E*List four things that can be done to avoid infectious diseases.
Explain the difference in the moving ability of the paramecium, euglena and amoeba.

Materials:

Textbook: Exploring Living Things, pp:194-211
References: Teacher's Overview, p. T55-59

Laboratory Experiments:

Do It Yourself: Look for protists, p.196
Investigate: How does the appearance of bacteria colonies differ? p.202.
Investigate: How does a paramecium take in food? p.207.
Activity No. 17: Effects of Antiseptics on Bacteria, pp.55-56
Activity Booklet

Films:

M2432 - Fresh Water Pond, 13 minutes
M2677 - Protist Kingdom, 14 minutes
M6212 - A Drop of Water, 15 minutes
6098 - Life in a Drop of Water, 10 minutes
7623 - Protist Reproduction, 10 minutes
7868 - Armauer Hansen, Discoverer of Leprosy Bacillus, 10 minutes
L5311 - Louis Pasteur, Man of Science, 26 minutes
M7624 - New Look at Leeuwenhoek's Wee Beasties, 12 minutes
M7535 - Protists: Threshold of Life, 12 minutes
M5180 - The Vision of Dr. Koch, 21 minutes
M2314 - World of Micro-Life, 14 minutes
M1854 - Microscopic Life, 14 minutes

Additional Activities:

Summing Up, p.210
Checking Up: Vocabulary, pp.210-211
Concepts, p.211.
Application and Critical Thinking, p.211
Doing More, Questions 1 and 2, p.211
Library assignments of men connected with bacteriology
Find Out More, p.195
Find Out More, p.200
Find Out More, p.205
Find Out More, p.208
Investigate on Your Own No. 1, p.286
Teaching Strategy for pp.197-198, T56
Teaching Strategy for p.198, T56
Teaching Strategy for p.203, T57
Teaching help for Doing More No. 1 (staining techniques) p.T59

In Guide:

Experiment: Study of Bacteria
Examples of Ways Bacteria are Helpful
Food Making with Bacteria
Protozoa Lab Investigation
Pond Water Organisms Chart
Exercise on Bacteria

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the characteristics of protists.	Have students read over Chapter 10, pp.194-209. Outline the four kinds of protists. E*Have students draw the plant cell and animal cell on page 197 and label all parts. List similarities and differences between the cells on the back of the drawing. Review Chapter 4, Classifying Living Things, pp.78-79. E*Have students prepare a chart showing the six phyla of the Protist Kingdom (See pp.78-79). Write the features that characterize each phylum, give examples of organisms belonging to each phylum, and include interesting facts about the organisms. Do It Yourself, Look for Protists, p.196. Teaching Strategy for pp.197-198, plant and animal cells, T56. Teaching Strategy for p.198, slime molds, T56.
Differentiate by recognizing and comparing kinds of bacteria.	E*Have students draw the three kinds of bacteria: coccus, bacillus, and spirillum. Use p.199 and 78 or use overhead transparencies. Furnish slides letting students study the three shapes of bacteria with the aid of the microscope. Find Out More, p.200.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Prepare bacteria cultures and recognize staining procedures.	Investigate: How does the appearance of bacteria colonies differ? p.202. Activity No. 17: Effects of Antiseptics on Bacteria, pp.55-56, Activity Booklet. Read over pp.200-204 for preparing bacteria culture. Put recipe for making culture on overhead projector and have students copy one. Give the types of media used, the staining methods, and food eaten. Doing More, No. 1, preparing slides, p.21. See Teaching Helps, T59, for staining techniques. Grow a culture of bacteria taken from "clean" tap water. Simply inoculate an agar plate with tapwater, incubate, and observe. *Have students inoculate nutrient agar with various substances: finger, pen, pencil eraser, hair, tooth tartar. Uncover one petri dish to the air of the room for 20 minutes. Cover the dishes, tape closed, and observe for several days. Record observations and form conclusions. (Use lysol to help kill the bacteria before carefully disposing the agar. Clean petri dishes well.)
Realize helpful and harmful effects of bacteria.	E*Have students compile a list of familiar products that are produced by bacterial action. Two lists should be made showing both harmful and helpful activities. Students may plan menus for a "party" to serve only those foods made by bacterial action.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	① Students interested in "natural" foods could do research on the use of preservatives in food products. E* Use biology books and reference booklets to write reports on the harmful and helpful bacteria. Use the material in your text on pp.203-204 as an aide. See Appendix for list of bacterial diseases. Students can demonstrate bacteria's ability to spoil food by placing a covered glass of milk in the room and one in the refrigerator. The next day, make observations by smelling the contents of both glasses and form conclusion. (Why did one glass sour before the other? Where did the bacteria come from if both glasses were covered?) Students can make cottage cheese, sauerkraut, or vinegar. (Activities are included in guide.) Students can orally discuss and then write a list on ways to avoid infectious diseases caused by bacteria. Invite the nurse to come talk about ways to prevent infectious diseases. Students can demonstrate the use of preservatives to help prevent food spoilage by bacteria with this activity: Pour beef broth into three beakers, add salt to one, vinegar to another, and nothing to the third. Label each, place in a dark, warm spot, and observe for several days. Record predictions, observations and conclusions. Discuss ways to prevent food spoilage by bacteria: canning, boiling, freezing, salting, drying, and high sugar content.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Teaching Strategy for p.203, plant nodules, T57..
	Investigate On Your Own, No. 1, nitrogen-fixing bacteria, p.286.
Compare and contrast the different examples of protists presented.	Have students set up hay infusions, allow at least one week. Try to find as many types of organisms as can be found.
	E*Make drawings of the amoeba, paramecium, and euglena, p.205. Label all structures.
	Distribute copies of Pond Water Organisms Chart to aid students in identification of organisms. (Included in Guide)
	Show films on protists to reinforce this activity.
	Note: There are good films which will help the students understand the Protist Kingdom. The ones listed under materials can be shown as time allows and when the teacher feels they would serve as a good supplement.
	Find Out More, p.205.
	Investigate: How does a paramecium take in food?
	Use references and give oral reports about diseases caused by protists: African sleeping sickness, amoebic dysentery, and malaria.
	@Have students devise a system for measuring the size of organisms under the microscope.
	*Prepare models to illustrate the various ways protists move (pseudopods, cilia and flagella). Suggested materials: styrofoam, gelatin, string, pipe cleaners, yarn.
	USE OF THE MICROSCOPE IS SIGNIFICANT.

EXPERIMENT: STUDY OF BACTERIA

Problem: What are bacteria? Where are they found and how do they grow?
What goes into making a culture? What is a control in any experiment? What are some of the medias in which bacteria grow?
How can we identify bacteria?

Procedure: Advanced preparation by teacher.

1. Prepare four petri dishes per table by washing them well. Drying and sterilizing. To sterilize, place dishes in brown paper grocery sack, fold closed and then staple at least twice. Heat in oven at 200°F for 30 minutes.
2. Prepare culture media by mixing 20 grams beef extract (or consomme or boullion) and 500 ml distilled water. Heat this mixture until it boils and slowly stir in 30 grams of agar (or unflavored gelatin).

ALTERNATIVE: Order tubes of sterile nutrient agar from the living resource center. One tube contains enough media to do three petri dishes. Melt this agar by standing opened tube in a beaker of boiling water.

3. Pour media into sterile petri dishes, cover and allow to cool. The culture media will gel.

Student Procedure:

1. Label 4 covered petri dishes 1 through 4. (Open #1 and leave exposed to the room air for five minutes).
2. Open #2, make a thumb print on the surface of the media and cover. Open #3, cough or sneeze over the media and cover.
3. Place all four covered petri dishes in a warm dark closet or cabinet for 3-4 days.
4. Observe daily and record your observations. List likenesses and differences in the colonies on the media in each dish.
5. Observe slides prepared by your teacher under the microscope and record your observations. List differences in shape.

Questions:

1. What was the purpose of the dish labeled 4?
2. Define bacteria. Bacteria are classified according to their shape.
3. List these three shapes and give the scientific name of each shape.
4. Where are bacteria found?

5. Name some natural medias for bacteria.
6. Define a "culture of bacteria".
7. Name some substances added to agar or gelatin to make media for special cultures.
8. How are bacteria identified?

Examples of Ways Bacteria are Helpful

PRODUCTS:

Alcohols (Butyl and Ethyl)

Butter

Buttermilk

Cheeses

Medicines

Proteolytic enzymes

Vinegar

Vitamins

Yogurt

PROCESSES:

Composting fertilizer

Garbage disposal

Leather tanning

Nitrogen fixation in soil

Processing certain fabrics and paper

Sewage digestion

FOOD MAKING WITH BACTERIA

Making Cottage Cheese

First let milk clabber. Use a sieve to strain the curds. Put the curds in clean cheese cloth and let it drip in a sunny, well ventilated place. Milk needs to curdle for three days. Take it down and salt it.

Making Sauerkraut

Make layers of shredded cabbage and salt. Sprinkle vinegar on this. Make several layers of this in a crock and cover with a cloth and put a weight on this. For the first 24 hours let the mixture remain uncovered. Let the mixture sit for two to three weeks.

Making Vinegar

Let a jar or flask of apple juice or juice of other noncitrus fruit sit overnight. Then close it with a cotton plug or piece of cloth. You may want to add a small quantity of yeast to speed up the conversion of sugar to alcohol.

Agitate it daily to maintain a high level of dissolved oxygen. Check daily with litmus or pH paper. Also, lift out mold colonies as they accumulate on the top of the liquid.

When the solution smells strongly of vinegar and has reached a pH of around 2.5, it may be tasted after filtering (and distilling if desired).

Yogurt

The best yogurt is homemade yogurt. Few Americans ever make it, possibly because like all living things, the bacterial cultures that transform milk into yogurt are somewhat unpredictable, but you can experiment with the process, using unflavored commercial yogurt as the culture or "starter." Pour one quart of milk into a heavy 2 to 3 quart enameled casserole with a tightly fitting lid. Stirring constantly to prevent any skin from forming on the top, heat the milk slowly until it reaches a temperature of 180° on a candy or deep-frying thermometer, or until small bubbles form around the edge. Remove from the heat and, stirring occasionally, allow the milk to cool to lukewarm (110° on the thermometer.) Immediately stir in 1/2 cup of commercial yogurt. Put the lid in place and wrap the top and sides of the casserole with towels to keep it warm. Then place the casserole in a warm draft-free spot where it can

stand undisturbed. After six hours or so, remove the wrapping. At this stage the yogurt should be jelled and somewhat firm. Transfer it to the refrigerator without shaking the casserole or stirring its contents, and chill the covered yogurt for four hours, or until it is firm. A quarter cup of it can serve as your "starter" next time.

*from Middle Eastern Cooking, Time-Life Books, New York, page 41.
Foods of the World series.

PROTOZOA

Lab Investigation

Materials:

Directions: Observe as many different protozoa as you can.
Prepare your slides in the same manner as we have
previously done.
Give the following data for any four (4) specimen:

- a. Name of specimen
- b. Drawing of specimen
- c. What it uses to move about
- d. Color
- e. Ciliate, Flagellate or Sarcodine?
- f. Most intriguing feature of this
microorganism?

I.

b.



a. Name _____

c. _____

d. _____

e. _____

f. _____

Words of Warning!! DO NOT USE MEDICINE DROPPERS FROM ONE
CULTURE TO ANOTHER!!

II.

b.



a. Name _____

c. _____

d. _____

e. _____

f. _____

b.



a. Name _____

c. _____

d. _____

e. _____

f. _____

IV.

b.



a. Name _____

c. _____

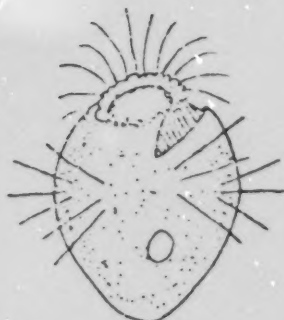
d. _____

e. _____

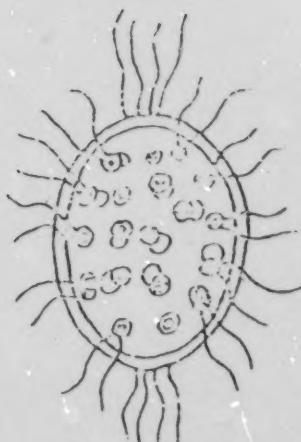
f. _____



Amoeba



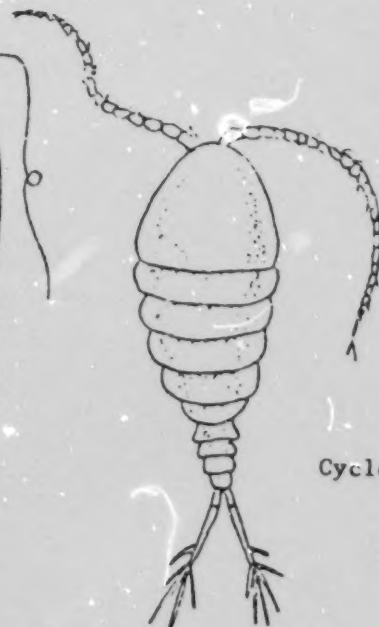
Halteria



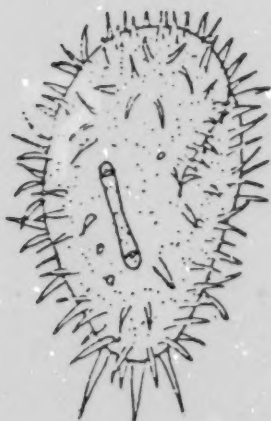
Pleodorina



Euglena



Cyclops



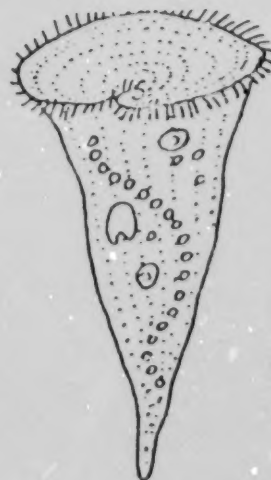
Stylonchia



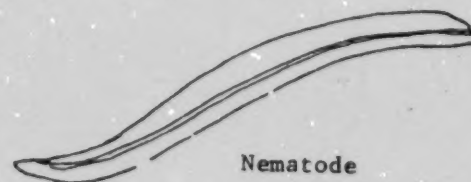
Vorticella



Paramecium



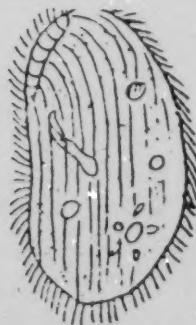
Stentor



Nematode



Arcella



Colpidium



Peranema



Gastrotrich

Exercise on Bacteria

Match the word with the phrase it most closely identifies.

- | | |
|------------------------------|------------|
| A. Protozoan | D. Malaria |
| B. Tropism | E. Colony |
| C. African sleeping sickness | |

- ___ 1. Caused by the tse-tse fly.
- ___ 2. An amoeba responds to the lack of food by moving to find it.
- ___ 3. Caused by a sporozoan
- ___ 4. Caused by a flagellate
- ___ 5. Amoeba
- ___ 6. Ciliate
- ___ 7. Flagellate
- ___ 8. Paramecium
- ___ 9. An amoeba responds to strong chemicals by moving away from them.
- ___ 10. Volvox
- ___ 11. Euglena
- ___ 12. Caused by a parasite produced by a sporozoan
- ___ 13. Single-celled organism
- ___ 14. Pseudopods
- ___ 15. If an amoeba comes in contact with food, it moves to capture it.

UNIT 4

ANIMAL KINGDOM: THE EATING KINGDOM

Time Allotment

28 days for entire unit

Chapter 15: Sponges and Coelenterates

Note: Chapter 4 was covered in Unit 2, but may be reviewed just prior to discussion of Chapter 15. Refer to pp.84-88 in text.

Advanced Preparations:

1. Collect live earthworms for Chapter 16.

Major Concepts to be taught:

- The structure of sponges
- The life functions of sponges
- The structure of coelenterates
- The life functions of coelenterates

Instructional Objectives:

The student should be able to -

- Describe the structure of a sponge.
- Explain how sponges reproduce.
- Describe the structure of a coelenterate.
- Explain the formation of a coral reef.

Assessment:

The student will:

- Identify on a drawing of a sponge the central cavity, pores, spicules and collar cells.
- Describe how sponges get their food and water.
- Differentiate between sexual and asexual reproduction in sponges.
- Name examples of coelenterates.
- Identify the shape of a coelenterate as radial symmetry.
- Identify the way in which coral reproduces.
- List the uses of porifera and coelenterates.
- Determine the more complex organism: sponge or coelenterate, and state reasons for choice.

Materials:

Textbook: Exploring Living Things, pp.290-303

References: Teacher's Overview, pp.T78-79

Laboratory Experiments:

Do It Yourself, Observe hydras, p.299.

Films:

M3455 - First Many Celled Animals: Sponges, 17 minutes

L4535 - Coral Reef, The, 17 minutes

L6825 - Coral Reef, 28 minutes

M7507 - Coral Jungle, 23 minutes

Suggested Activities:

Summing Up, p.302

Checking Up: Vocabulary, p.302

Knowledge and Understanding, p.303

Concepts, p.303

Application and Critical Thinking, p.303

Doing More, Questions 1 and 2, p.303

Do It Yourself, Make a model, p.293

Find Out More, p.292

Find Out More, p.300

Teaching Strategy for p.291, T79

Teaching Strategy for pp.291-292, T79

Teaching Strategy for pp.296-300, T81

In Guide:

Sponges Information Sheet

Sponges Worksheet

Hydra: A Typical Coelenterate Information Sheet

Hydra: A Typical Coelenterate Worksheet

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the structure of a sponge.	Show preserved samples of sponges to class to illustrate the animal group proifera. *Use lab charts, if available, to illustrate. Have students draw diagrams on p.292, structures in sponges. Distribute Sponges Information Sheet, in guide. Have students complete Sponges Worksheet, in guide. Have students read aloud in class, Chapter 15, pp.290-301. Discuss the questions in the margins as class discussion. Find Out More, p.292. *Do It Yourself, Make a model, p.293. Teaching Strategy for p.291, Problems in classifying sponges, T79. Teaching Strategy for pp.291-292, handling sponges, T79. Collect pictures of various kinds of sponges and make a bulletin board display. Try to find as much information about each, and prepare a report. Tear off a small piece of natural sponge, observe in microscope to find spicules. Students can use a balance in studying sponge structure. Measure in grams the weight of a dry sponge. Record. Soak the sponge in water, let excess water drip out, and measure weight. Record. Figure the amount of water absorbed by the sponge. Form conclusions as to how the body structure of the sponge allows it to hold water. Doing More, No. 1, p.303. Discuss uses of the sponge.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Explain how sponges reproduce.	Have students copy the outline on overhead projector of the steps of sexual reproduction of sponges. Note also that pieces may be attached to stones to grow into new sponges (asexual). Have students do reports on the sponge industry and how they are harvested. Teaching Strategy for pp.293-296, sponge reproduction, T80.
Describe the structure of a coelenterate.	Show preserved specimens to students as this group is very colorful and is called the flowers of the sea. Do It Yourself: Observing hydra, p.299. Distribute Hydra: A Typical Coelenterate Information Sheet, in guide. Have students complete Hydra: A Typical Coelenterate Worksheet, in guide. Teaching Strategy for pp.296-300, Coelenterate chart, T81. Demonstrate the body structure of a coelenterate by showing a paper bag with the top squeezed, leaving a small opening. *Using a microprojector, place a hydra and daphnia on a slide. Students can write descriptions on how the hydra captures and eats its prey. Observe prepared slides of budding hydra using a microscope. Review sexual and asexual reproduction. *Collect pictures of other organisms that have radial symmetry. Describe differences and similarities between them.
Explain the formation of a coral reef.	Show movies on the coral seas and reefs and the animals in this habitat to illustrate the specimens of this group. Use references and find out how coral reefs are formed and how coral reproduce.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have students bring in their collections of coral for class Show and Tell. Doing More, No. 1, p.303. Find Out More, p.300. Using a piece of coral, show the openings where the coral animal protrudes. Have students write reports on the different careers in oceanography (See p.301.)

SPONGES

PURPOSE:

To study the structure and some of the life functions of sponges.

MATERIALS:

Microscope, preserved specimen of Grantia, prepared slides of a longitudinal section of Grantia, a cross section of Grantia, sponge spicules, and spongin network.

EXPLANATION:

Sponges are "pore-bearing" animals which live in water. While some sponges can be found in fresh water, they are primarily marine (salt water) animals. The body parts of many sponges are regularly arranged about a central point and radiate out from this point just as the spokes of a wagon wheel radiate out from the hub. Therefore, we say that these sponges are radially symmetrical. Some sponges do not have a regular arrangement and are said to be asymmetrical.

Sponges are found growing on rocks. They appear as vase-shaped organisms covered with tiny openings called pores. Water is constantly being pulled in the pores and forced out the top end or osculum, of the sponge.

All sponges have two cell layers with a "skeleton-of-sorts" and a jelly-like substance between these cell layers. The outer layer is composed of epidermal cells which serve to protect the inner cells. The inner layer is composed of cells possessing flagella (whiplike tails). The constant beating of these flagella cause a constant flow of water out the osculum. The skeleton of the sponge is of two types:

1. Spicules: The skeleton of some groups of sponges is composed of needle shaped structures.
2. Spongin: The skeleton of another group of sponges is composed of a protein material. (This is the material that is sometimes used as a bath sponge.)

The water moving into the sponge through the pores carries food particles and oxygen to the inner layer of flagellated cells, the choanocytes (commonly called collar cells). The choanocytes digest and absorb the foods and absorb the oxygen. They then pass some of the food and oxygen to the epidermal cells, which cannot digest their own food.

Sponges reproduce by budding, a process whereby a new individual forms on the side of the parent. They also reproduce sexually.

PROCEDURE I: The Structure of a Sponge

1. Obtain a preserved specimen of the sponge, *Grantia*. Leave it in the container.
2. Study the external features of the sponge with a hand lens and identify the following structures: (a) the osculum, (b) the pores, (c) the spicules (they appear as bristles sticking out of the epidermal cells), and (d) a bud (if present). Make the drawing indicated in Item 1, Observation and Conclusions.
3. Obtain a prepared slide of a cross section of *Grantia* and examine it under low power of the microscope. Identify the following structures: (a) collar cells, (b) epidermal cells, (c) spicules, and (d) pore cells (these are specialized epidermal cells). Make the drawing indicated in Item 2, Observations and Conclusions.

PROCEDURE II: Observation of Sponge Skeletons

1. Obtain a prepared slide of sponge spicules and examine it under low and high power of the microscope.
2. Observe the different shapes of the spicules. Note the angles at which the different extensions of the spicules come together. Make the drawing indicated in Item 3-a, Observations and Conclusions.
3. Obtain a prepared slide of spongin network and study it under low and high power of the microscope. Make the drawing indicated in Item 3-b, Observations and Conclusions.

SPONGES WORKSHEET

OBSERVATIONS AND CONCLUSIONS:

1. Make a drawing of the external features of Grantia and label the structures you identified in Step 2 or Procedure I.

Grantia

2. Make a drawing of a cross-section of Grantia and label the structures you identified in Step 3 of Procedure I.

Cross Section of Grantia

3. Make the drawings indicated below:

a. Sponge Spicules

b. Spongin Network

QUESTIONS FOR RESEARCH:

1. Some zoologists think of a sponge as being a colony of protozoa living in a symbiotic relationship. Answer the following questions regarding this statement:
 - a. What is a symbiotic relationship?
 - b. What evidence can you find (or perhaps conclude from the Explanation) that would support this belief?
 - c. What single life process would lead you to conclude that it is a multicellular animal?
2. How are "commercial" sponges prepared for use?

HYDRA: A TYPICAL COELENTERATE

PURPOSE:

To study the structures common to coelenterates, through an examination of hydra.

MATERIALS:

Microscope, prepared slides of a whole hydra and a longitudinal section of a hydra (Optional: living hydra)

EXPLANATION:

Probably the most familiar of the coelenterates is a little cuplike animal that we see sometimes at the beach, the jellyfish. Other familiar coelenterates are the man-of-war and the various types of coral. What we normally think of as coral is actually the exoskeleton (exo-outside) of the soft-bodied animal, coral.

The coelenterates are the lowest forms of multicellular (many-celled) animals that have cells arranged into definite tissues. They are also the simplest of the animals which have a cavity (hollow place) where all digestion for the animal takes place. Coelenterates have two layers of cells, the endoderm (inside layer) and the ectoderm (outside layer), separated by a non-cellular, jellylike layer.

The coelenterates, like the protozoans, serve as food for larger sea animals. The corals produce mineral skeletons that are sometimes used to make jewelry and decorations for the home.

The hydra, one of the few fresh-water coelenterates, is the favored species for study. Like all coelenterates, it has a two-layered body separated by a jellylike material, and is radially symmetrical.

The hydra's body is a hollow tube with one end open and the other closed. The closed end forms the foot, or basal disc, of the hydra. This is the structure by which the hydra attaches itself to an underwater plant or rock. The open end is the mouth, of hypostome, which is surrounded by projections called tentacles.

The tentacles of the hydra, like those of the jellyfish, contain nematocysts (stinging cells). The hydra uses these nematocysts to paralyze smaller animals in order to secure them for food. The tentacles then surround the small animals and push it through the mouth into the digestive cavity.

The hydra uses its tentacles to move about. Sometimes the hydra slides along on its basal disc, but most often it walks on its tentacles or uses them in turning somersaults.

Reproduction in hydra occurs asexually by budding or regeneration (a part broken off develops into a new individual). Hydra also reproduce sexually. During the fall and winter months the hydra begins to develop bulges on the lower and upper parts of its tube-like body. The lower bulge produces the egg cell, and the upper bulge produces the sperm cells. The sperm cells, when released, swim to and unite with the egg cell. The fertilized egg then develops through various stages to produce an adult hydra.

PROCEDURE I: External Structure of the Hydra

1. Obtain a prepared slide of a whole hydra and focus it under the low power of the microscope.
2. Study the external structure of the specimen by moving the slide around beneath the objective. Focus up and down with the fine adjustment in order to get a concept of the thickness of the specimen.
3. Identify the following structures: (a) basal disc, (b) the body, (c) tentacles, and (d) hypostome. If they are present, you may also identify the bulges which contain the male and female sex cells. Make the drawing indicated in Item 1, Observations and Conclusions. Count the number of tentacles and include each one in your drawing. If a bud (young hydra) is growing from the hydra, include it in your drawing.

PROCEDURE II: Internal Structure of the Hydra

1. Obtain and study a longitudinal section of hydra. You will have to move the slide around and focus frequently in order to study the overall internal structure.
2. Identify the following structures: (a) the cavity, (b) the two cell layers, ectoderm and endoderm, and (if present in your slide) (c) the hypostome, and (d) tentacles. Make the drawing indicated in Item 2, Observations and Conclusions.
3. Examine the body layers and the tentacles and note the difference in the kinds of cells present. Make the drawings indicated in Item 3, Observations and Conclusions.

PROCEDURE III: Optional Procedure

1. Since hydra grow attached to rocks and vegetable matter in slow-moving, shallow, fresh water, some of you may wish to bring live specimens to class for study. Study them and observe the following life activities. After doing so, answer the related questions in the Questions for Research: (a) movement, (b) ingestion, (c) contraction and expansion. Note also whether any of the hydra are budding.

2. Hydra are best studied through a dissecting microscope. However, they can be studied under low power of the compound microscope. The living culture should be placed in a watch glass with 1/8 inch of water.

HYDRA: A TYPICAL COELENTERATE

OBSERVATIONS AND CONCLUSIONS:

1. Make a drawing of the external view of a hydra and label (a) basal disk, (b) body, (c) tentacles, and (d) hypostome.

Hydra--External View

2. Make a drawing of a cross section of a hydra and identify the structures listed in Step 2 of Procedure II.

Hydra--Cross Section

3. Make drawings of the different kinds of cells present and, by using books that are available to you, label them as to kind and function.

4. Does the body cavity extend into the tentacles?

QUESTIONS FOR RESEARCH:

1. What functions do nematocysts serve?
2. How does the hydra ingest its food?
3. How does the hydra move from one point to another?

Chapter 16: Worms

Advanced Preparations: None

Major Concepts to be taught:

Characteristics of flatworms (Platyhelminthes)
Characteristics of roundworms (Nematoda)
Characteristics of segmented worms (Annelida)

Instructional Objectives:

The student should be able to -

Describe the structure of flatworms, round worms, and segmented worms.

Explain life functions of the flatworm.

Identify worms that are parasitic.

Identify characteristics of segmented worms.

Assessment:

The student will:

Identify examples of flatworms, roundworms and segmented worms.

Define bilateral symmetry and identify examples of organisms that have bilateral symmetry.

Define regeneration and describe this process in the planarian.

Identify the more complex organism (planarian or tapeworm) and state reasons for choice.

Identify these worms as parasitic or nonparasitic: earthworm, tapeworm, trichina, planarian, blood leech, hookworm.

Describe how a person can become infected by parasitic worms.

Explain how earthworms help keep the soil fertile.

Materials:

Textbook: Exploring Living Things, pp.304-319

References: Teacher's Overview, pp. T82-87

Laboratory Experiments:

Do It Yourself: Observe Planarians, p.306.

Investigate: How does the earthworm respond to light, touch, and chemicals in the soil? p.315.

Activity No. 23: Regeneration in Planarians, pp.69-72,

Activity Booklet

Activity No. 24: Responses of Earthworms, pp.73-76, Activity Booklet

Films:

M7532 - Invertebrates: Conditioning or Learning, 15 minutes

Suggested Activities:

Summing Up, p.318

Checking Up: Vocabulary, p.318

Knowledge and Understanding, p.319

Concepts, p.319

Application and Critical Thinking, p.319

Doing More, Questions 1 and 2, p.319

Parasitologists (Careers), p.317

Find Out More, p.309

Find Out More, p.311

Find Out More, p.314

Do It Yourself, Catch Some roundworms, p.312

Teaching Strategy for pp.307-309, T84 (parasites)

Teaching Strategy for pp.309-312, T85 (roundworms)

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the structure of flatworms, roundworms, and segmented worms.	Read aloud in class, Chapter 16 and go over all questions in the margins. Have students copy from an overhead projector, diagram of each type of worm: flatworm, segmented worm, and roundworm. Show difference of each type. Students can discuss likenesses and differences between them and list their conclusions on the back of the drawing. Have students make posters of each type of worm, in their habitats. Have a field trip around the school campus to dig up moist soil, leaves and plant roots. Examine with hand lenses or microscopes for worms or nematodes. Do It Yourself, Catch some roundworms, p.312. Teaching Strategy for pp.309-312, roundworms, T85. *Discuss the meaning of bilateral symmetry, name the worm that has this shape. Students can collect pictures or name examples of other organisms that are bilateral in shape.
Explain life functions of the flatworm.	Copy the diagram of regeneration on p.307. Discuss other organisms that can regenerate. Do It Yourself: Observe planarians, p.306. Teacher demonstration. A review of the meanings of sexual and asexual reproduction can be given here. Activity No. 23: Regeneration in Planarians, pp.69-72. (Teacher demonstration)

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Identify worms that are parasitic.	*E*Read Chapter 16 and list the worms that are parasitic. Discuss ways to prevent infection of worms. Find Out More, p.309. Find Out More, p.311.~ Doing More, No. 1, p.319. Students may be able to obtain tapeworm samples from a veterinarian. (See Teaching Strategy for pp.307-309, flatworms, T84.) Research and give oral reports on parasitic worms: heartworm, Chinese liver fluke, ascaris, hookworm, tapeworm, trichina, filaria, pinworms, blood sucking leeches. Discuss Careers: Parasitologists. (See Helps for Careers, T86.)
Identify characteristics of segmented worms.	Lab: How does the earthworm respond to light, touch, and chemicals in the soil? p.315. Read article in margin on p.314 and discuss as a panel discussion. Have students do research to see how many kinds of worms are beneficial to man. Also reports on leeches for medicinal purposes can be made here. Find Out More, p.313.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Doing More, No. 2, p.319. Activity No. 24: Responses of Earthworms, pp.73-76. Separate a shoe box into four parts with cardboard inserts. In the different sections place 1) moist, sandy soil, 2) moist leaves and grass, 3) dry, sandy soil or 4) dry coffee grounds. Drop some earthworms into a container, set in a cool, dark box overnight and observe the next day to see which container the worms prefer.

Chapter 17: Mollusks, Arthropods, and Echinoderms

Advanced Preparations: None

Major Concepts to be taught:

- Characteristics of mollusks
- Characteristics of arthropods
- Characteristics of echinoderms

Instructional Objectives:

The student should be able to -

- Describe characteristics of mollusks.
- Describe characteristics of arthropods.
- Describe characteristics of echinoderms.

Assessment:

The student will:

- Identify examples of mollusks, arthropods, and echinoderms.
- Identify differences and similarities between gastropods, bivalves, and cephalopods.
- Match a description of the three phyla to their proper names.
- Define metamorphosis and describe the difference between incomplete and complete metamorphosis.
- Identify the external parts of the grasshopper.
- Differentiate between arachnids and insects and name examples of each.
- Identify where echinoderms live and name two examples.
- Determine the more complex organism, mollusk, arthropod or echinoderm, and state reasons for choice.

Materials:

Textbook: Exploring Living Things, pp.320-339
References: Teacher's Overview, pp.T87-91.

Laboratory Experiments:

- What are the parts of the grasshopper? p.329
- Do It Yourself: Examine a clam, p.324.
- Do It Yourself: Observe echinoderms, p.336.
- Activity No. 25: The Ant: A Colonial Insect, pp.77-78,
Activity Booklet
- Activity No. 26: The Life Cycle of a Mosquito, pp.79-80,
Activity Booklet

Activity No. 27: Hatching Brine Shrimp Eggs, pp.81-84,
Activity Booklet

Films:

- M7764 - Octopus, Octopus, 21 minutes
- L4780 - Castles in the Sea, 24 minutes
- L4513 - Knights in Armor, 24 minutes
- M2927 - Crayfish, The, 15 minutes
- L6227 - Hidden World: A Study of Insects, 24 minutes
- M3235 - Insect Metamorphosis, 15 minutes
- M3558 - House Fly, The, 17 minutes
- 3987 - Monarch Butterfly Story, 11 minutes
- M2482 - Secrets of the Ant and Insect World, 13 minutes
- M7537 - Spiders: Aggression and Mating, 17 minutes
- 3451 - Life Story of a Water Flea, 10 minutes
- 5525 - Starfish, 10 minutes
- 3454 - Life Story of the Sea Star, 11 minutes
- M4427 - Echinoderms and Mollusks, 16 minutes
- M3698 - Adaptations of Insects, 13 minutes
- 7818 - Gypsy Moths: Vandals of the Forest, 10 minutes

Suggested Activities:

- Summing Up, p.338
- Checking Up: Vocabulary, p.338
 - Knowledge and Understanding, pp.338-339
 - Concepts, p.339
 - Application and Critical Thinking, p.339
- Doing More, Questions 1 and 2, p.339
- Find Out More, p.327
- Find Out More, p.328
- Find Out More, p.332
- Find Out More, p.336
- Investigate On Your Own, Questions 2 and 3, pp.382-383
- Teaching Strategy for pp.321-322, T88
- Teaching Strategy for pp.322-323, T88
- Teaching Strategy for p.324, T88
- Teaching Strategy for pp.321-325, T89
- Teaching Strategy for pp.328-330, T89
- Teaching Strategy for p.331, T90
- Teaching Strategy for p.332, T90
- Teaching Strategy for pp.328-332, T90
- Teaching Strategy for pp.334-336, T91

In Guide:

- The Grasshopper: A Typical Insect, Information Sheet
- The Grasshopper: A Typical Insect, Worksheet
- The Starfish: A Typical Echinoderm, Information Sheet
- The Starfish: A Typical Echinoderm, Worksheet

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe characteristics of mollusks.	Have students copy diagram of the clam on T88 in teacher's section. Project it on the overhead. Read over Chapter 17, pp.320-327. Go over kinds and parts of all mollusks. Answer questions in margin as a class discussion. Do It Yourself: Examine a clam, p.324. Make a chart or table showing the main characteristics of gastropods, bivalves and cephalopods and list representatives of each group. *Students can name examples of mollusks that they have eaten. (See Teaching Strategy, pp.321-322, T88 for other uses.) @Students can use reference books to check the main difference between an open and a closed circulatory system. Show the difference in a drawing. Find Out More, p.327. Investigate on Your Own, No. 2, Snail egg observation, p.282. Teaching Strategy for pp.322-323, Oyster drill, T88. Teaching Strategy for pp.321-325, collect and identify shells, T89. Observe live snails (order from Oceanography Center). Place one first on a piece of paper and then on a piece of sandpaper. Measure in cm. the distance it moves in five minutes on each paper. Draw the snail and label identifiable body structures. Form conclusion on how snails respond to different surfaces.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Collect different live snails. Spread talcum powder on the bottom of a pan. Observe the snail trails. Students can hypothesize on what factors determine the snail's trails. Research into why gardeners consider land snails and slugs to be pests. Doing More, No. 1, p.339
Describe characteristics of arthropods.	Read over pp.327-332. Answer questions in the margin. Distribute copies of The Grasshopper, A Typical Insect Information Sheet, in guide. Have students complete The Grasshopper, A Typical Insect Worksheet, in guide. Have students draw diagram of grasshopper from text on p.328, figure 17-8. Lab: What are the parts of the grasshopper? p.329. Activity No. 25: The Ant: A Colonial Insect, pp.77-78. Activity No. 26: The Life Cycle of A Mosquito, pp.79-80. Activity No. 27: Hatching Brine Shrimp Eggs, pp.81-84. Doing More, No. 2, p.339. Investigate On Your Own, Collect insect cocoons, pp.382-383. Teaching Strategy for pp.328-330, insect collections, T89. Teaching Strategy for p.331, observe spider webs, T90. Teaching Strategy for p.332, collect crustaceans, T90. Teaching Strategy for pp.328-332, raising arthropods, T90.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Find Out More, p.328. Find Out More, p.332. *Using the microprojector or microscope, observe the beating heart of a daphnia. Check local sources for information concerning the presence of these arthropods in this area: 1) poisonous spiders 2) poisonous scorpions 3) ticks that transmit disease-causing agents Prepare a chart showing ways to recognize each of these animals. @Do library research on the social behavior of ants and bees. Give oral reports. Have students compare arachnids to insects. Make a chart using pictures, collected or drawn, and list differences and similarities. Have students capture live crayfish, place in a terrarium, make observations of body structure and behavior. Collect and examine different insects (or pictures of insects). Attempt to classify the specimens according to the general characteristics. Use references to help. Make microscopic slides of butterfly wing scales. Describe. Observe the stages of development of tenebrio larvae (mealworms). They can be ordered from Oceanographic Center.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Do library research as to how insects may be collected, safely killed, and properly mounted and preserved. Students can look for discarded arthropod skeletons from window sills and corners. Make observations. Compare insect exoskeletons to vertebrate endoskeletons. *Research into the different ways spiders capture their prey. Make drawings or collect pictures. Bring in live insects in containers. Make observations. Compare antennae, legs, and wings. Make drawings or charts to show differences.
Describe characteristics of echinoderms.	Bring in dried specimens of starfish and sand dollar to view for students. See if your school has preserved specimens of sea cucumber, brittle star and basket star for viewing. Students can list differences and similarities between them. Distribute copies of The Starfish: A Typical Echinoderm, Information Sheet, in guide. Have students complete The Starfish: A Typical Echinoderm, Worksheet, in guide. Show movies on this group as there are some good color films available for this group. Do It Yourself: Observe echinoderms, p.336. Find Out More, p.336. Teaching Strategy for p.333, research on echinoderm spines, T91. Teaching Strategy for pp.334-336, echinoderm pictures, T91.

THE GRASSHOPPER: A TYPICAL INSECT

PURPOSE:

To study the structure and life activities of the grasshopper.

MATERIALS:

Preserved grasshopper, hand lens, forceps

EXPLANATION:

The grasshopper is a common insect. Insects are members of the phylum of animals known as arthropods. This phylum has more than 675,000 species, with members in all regions of the world. They live on land and in water. Other species of this phylum are ants, bees, spiders, lobsters, and crabs.

Arthropods may differ in outward appearance, but all species have the following structural similarities: (1) segmented body, (2) jointed exoskeleton, and (3) jointed appendages (legs, antennae, etc.). Otherwise, there are many structural differences in this phylum. These differences allow the arthropods to be separated into four distinct groups: (1) the crustaceans, (2) the arachnids, (3) the myriapods, and (4) the insects.

The crustaceans are primarily water dwellers, with a hard exoskeleton covering their segmented bodies. They have legs for locomotion and gills for respiration. Many of them, such as lobsters, crabs, crayfish, and shrimp, are used as food for man.

The arachnids, primarily land animals, have eight legs. Since they are land animals, they have adapted their respiratory systems for breathing air. This group of arthropods includes spiders, ticks, and scorpions.

The myriapods are land dwellers also. They have long, rounded bodies composed of many segments. Nearly all segments of the myriapods have one or two pairs of jointed legs. The centipedes generally have one pair of legs per segment and the millipedes generally have two pairs of legs per segment.

The insects compose the largest group of the arthropods. They are primarily land animals and exhibit the following structural features: (1) a body divided into three segments--head, thorax, and abdomen; (2) an exoskeleton of chitin; (3) three pairs of legs; (4) one pair of antennae; and (5) in most cases, two pairs of wings.

Most insects are harmful to man because they damage crops and carry diseases. Some of the most common harmful insects are grasshoppers, chinch bugs, lice, termites, flies, mosquitoes, and some moths. On the other hand, some insects are helpful to man. Such insects include the praying mantis and the lady bud beetle, which kill some of the harmful insects; the honey bee, which produces honey and helps pollinate plants; and the silkworm (larvae of a moth), which makes silk.

One of the insects most destructive to crops is the grasshopper. In addition to the common structural features of insects, such as a body divided into head, thorax, and abdomen, it has the following structural features in each part:

1. Head

- a. Two large compound eyes on each side of the head, which aid in detecting motion
- b. Three simple eyes, two in front and one between the compound eyes, which are sensitive to changes in light
- c. Two jointed antennae, which possess the senses of smell and touch
- d. A mouth, which consists of the following parts: (1) the labrum or upper lip, (2) the labium or lower lip, (3) the mandibles or toothed jaws, and (4) the maxillae or accessory jaws behind the mandibles

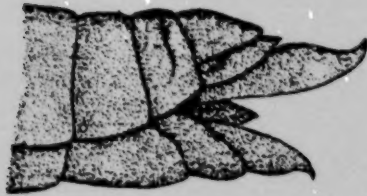
2. Thorax

- a. Consists of three segments
- b. The first and second segments have pairs of legs adapted for walking and climbing. (The first segment is covered by a skeletal plate, the pronotum.)
- c. The third segment has legs with enlarged muscles for jumping.
- d. The second and third segments have pairs of wings for flight.
- e. The second and third segments have spiracles for respiration.

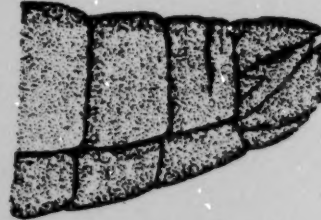
3. Abdomen

- a. Consists of ten segments
- b. The first segment contains a pair of tympana for hearing.
- c. The second through ninth segments have spiracles for respiration. The spiracle is an opening or pore which leads to a branching tube called the tracheae. The tracheae carries oxygen to each cell and removes the carbon dioxide.

- d. The tenth segment appears as a blunt structure in males and is modified into two blunt spines in the female. (This tenth segment or ovipositer of the female is specialized for egg laying. See the drawings below.)



Female



Male

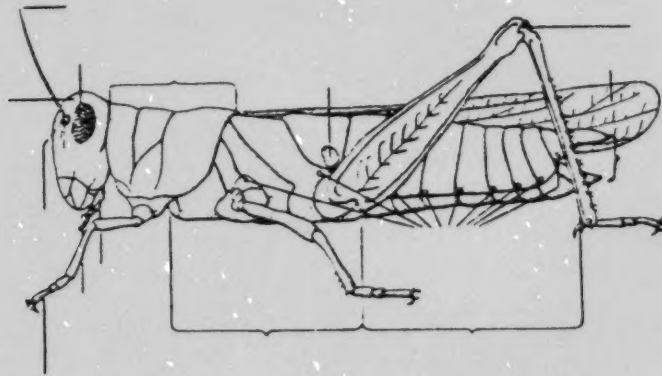
PROCEDURE: The External Structure of a Grasshopper

1. Obtain a preserved grasshopper and study it with a hand lens.
2. Identify the three body regions--head, thorax, and abdomen.
3. Study each of the body regions and identify each of the structures mentioned in the Explanation. As you do so, use forceps to remove the mouth parts. Study them carefully with the hand lens. Label the drawings in items 1 and 2, Observations and Conclusions.
4. Using forceps, remove a small portion of the chitin and study it with the hand lens. Feel it to determine its texture. Answer Item 3, Observations and Conclusions.
5. Remove one of the walking legs and one of the jumping legs. Examine the muscle tissue at the base of each one of them. Answer Item 4, Observations and Conclusions.
6. Remove one of the outer and one of the inner wings and examine them under low power of the microscope. Make the drawing indicated in Item 5, Observations and Conclusions. Answer Item 6.

THE GRASSHOPPER: A TYPICAL INSECT

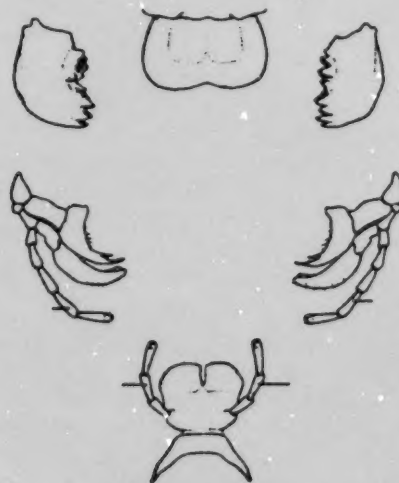
OBSERVATIONS AND CONCLUSIONS:

1. Label the following drawing:



The Grasshopper

2. Label the following drawings:



The Mouth Parts of a Grasshopper

3. Describe the appearance and texture of chitin.
4. Describe the special adaptations of the grasshopper for walking and jumping.
5. Make a drawing of a portion of the wing of the grasshopper as it appears under low magnification.
6. Describe the special adaptations of the grasshopper for flying.

QUESTIONS FOR RESEARCH:

1. Which species of grasshoppers is most destructive to crops? Why?
2. Study texts and charts to learn ^{how} the grasshopper (or insects in general) carry out the life activities of digestion and circulation, and summarize each.

THE STARFISH: A TYPICAL ECHINODERM

PURPOSE:

To observe the external structure and learn of some of the life activities of the starfish

MATERIALS:

Preserved specimen of a starfish, shallow pan, hand lens

EXPLANATION:

The group of animals called echinoderms live in salt water, mainly in shallow water along the coast. They have rather odd-looking external features, such as we see in the starfish, the sea urchin, and the brittle star. Their bodies are covered with a spiny skin. They reproduce sexually and by regeneration.

The starfish, one of the better known echinoderms, will be studied in this experiment. Its body consists of five arms connected to a "central disc." The upper surface of the body is covered with many small projections called "spines." The under surface of the arms contains hundreds of small, fingerlike structures called tube feet, which enable the starfish to move about and also aid in the food-getting process. When the starfish comes upon an oyster or a clam, it wraps its arms around it and attaches the suckers of its tube feet to the shell. By exerting a steady pull on the shell of the oyster, the starfish causes the oyster to tire and relax its muscles, thus allowing its shell to open. The starfish then pushes its stomach, inside-out, into the shell of the oyster. The soft body of the oyster is digested by enzymes secreted from the stomach of the starfish. The starfish then absorbs the digested food and pulls its stomach back into its own body.

Starfish are an economic hazard to man in that they destroy oyster beds. Many years ago when an oyster fisherman found a starfish, he would cut it into fragments. This practice only produced more starfish, however, since they reproduce by regeneration.

PROCEDURE:

External structure of a starfish

1. Obtain a preserved specimen of a starfish and place it in a shallow pan, in about 1/2 inch of water.
2. Note that the body of the starfish consists of a central disc surrounded by five pointed arms.

3. Examine the upper surface with a hand lens and identify the madreporite. This structure appears as a round plate near the center of the central disc. It is a little different in color. The madreporite is a seive (porous) plate which provides an opening through which water enters the water vascular (circulatory) system of the starfish.
4. Examine the center of the madreporite very carefully with a hand lens. In a well-preserved specimen you should be able to find a very small anal opening.
5. Examine the "spiny skin" of the starfish. Note its texture by rubbing it with your finger. Examine the spines with a hand lens and note their appearance. They serve to protect the starfish. Look carefully for tiny pincherlike organs, the pedicellariae, which appear as a ring of whitish dots about the spine. They are continuously opening and closing in a living starfish. They serve to "chop up" and remove any foreign matter and to prevent the growth of barnacles or similar organisms.
6. Examine the tip of each arm with a hand lens. Unless the preserving liquid has bleached out their color, you should find a small orange "dot." These structures, the eye spots, are sensitive to light.
7. Study the lower surface of the starfish and locate the mouth. It is located in the center of the central disc. (In some specimens the mouth may be hidden by a gray mass, the stomach, which is turned inside-out.)
8. Note the groove extending from the mouth to the tip of each arm. Examine the groove carefully and observe the four rows of tube feet. Careful examination of the tube feet will reveal a suction cup at the base of each one of them. In addition to their functions in locomotion and food-getting, they serve a function in the water vascular system.
9. Complete the items in Observations and Conclusions.

THE STARFISH: A TYPICAL ECHINODERM

OBSERVATIONS AND CONCLUSIONS:

1. Make a drawing of the upper surface of the starfish and label it with the names of the structures you identified in steps 2 through 6 of the procedure.

Starfish - Aboral View

2. What is the function of the madreporite?
3. What is the function of the "spines?"
4. What is the function of the pincherlike organs (pedicellariae) surrounding the spines?

5. Make a drawing of the underside of the starfish and label the structures you identified in steps 7 and 8 of the procedure.

Starfish - Oral View

6. What are the functions of the tube feet?
7. Describe the feeding habits of the starfish.

QUESTIONS FOR RESEARCH:

1. What is the function of the water vascular system of the starfish?
2. How extensive is the digestive system, the nervous system, and the reproductive system of the starfish? Describe each.

Chapter 18: Fish, Amphibians, and Reptiles

Advanced Preparations: None

Major Concepts to be taught:

The characteristics of fish
The characteristics of amphibians
Some characteristics of reptiles

Instructional Objectives:

The student should be able to -
Describe characteristics of fish.
Describe characteristics of amphibians.
Describe characteristics of reptiles.

Assessment:

The student will:

Describe the similarities and the differences of bony, jawless, and cartilaginous fish, determine which is most complex and name examples of each.
Identify three examples of amphibians.
Distinguish between frogs, toads and salamanders.
Describe differences and similarities between salamanders and lizards.
Describe metamorphosis in frogs and toads.
Determine differences between amphibians and reptiles.
Identify examples of reptiles.
Recognize and identify four poisonous snakes found in this area: water moccasin, coral snake, copperhead, rattle snake.
Name one positive use of snakes.
Determine the more complex organism: fish, amphibian or reptile, and state reasons for choice.

Materials:

Textbook: Exploring Living Things, pp.340-359
References: Teacher's Overview, pp.T92-96

Laboratory Experiments:

Investigate: How long does it take for a newly hatched tadpole to grow into an adult frog? p.351.
Do It Yourself: Observe a reptile, p.355.
Do It Yourself: Study fish in an aquarium, p.342.

Activity No. 28: Conditioning a Goldfish, pp.85-86
Activity Booklet.

Activity No. 29: Structure and Function in Frogs, pp.87-90
Activity Booklet.

Films:

- M5458 - Fish: Master of Movement, 12 minutes
- M7516 - Sharks, 22 minutes
- 2911 - Life Story of the Toad, 10 minutes
- M4636 - Frogs and How They Live, 15 minutes
- M2493 - Frog: A Familiar Amphibian, 15 minutes
- L7536 - Reptiles, 20 minutes
- M7758 - Green Sea Turtle, 21 minutes
- M4649 - Snakes and How They Live, 13 minutes
- 8014 - Snake Hunt, 10 minutes

Suggested Activities:

Summing Up, p.358

Checking Up: Vocabulary, p.358

Knowledge and Understanding, p.358

Concepts, p.359

Application and Critical Thinking, p.359

Doing More, Questions 1 and 2, p.359

Find Out More, p.342

Find Out More, p.343

Find Out More, p.346

Find Out More, p.347

Find Out More, p.356

Investigate On Your Own, No. 1, p.382

Teaching Strategy for p.341, T93

Teaching Strategy for pp.341-342, T93

Teaching Strategy for p.348, T94

Teaching Strategy for pp.348-350, T94

Teaching Strategy for pp.345-350, T94

Teaching Strategy for p.353, T95

Teaching Strategy for pp.353-354, T95

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will - Describe characteristics of fish.	Have the students observe live or preserved fish without referring to the text. Record observations of external features. Then compare observations to text or other resources. Read aloud in class, Chapter 18, pp.340-357. Answer all questions in the margin as a class discussion. Do It Yourself: Study fish in an aquarium, p.342. Activity No. 28: Conditioning a Goldfish, pp.85-86, Activity Booklet Outline the characteristics of each kind of fish and give an example of each from pp.341-344. *Have students cut out pictures of each kind and make charts or posters. Use "Field and Stream," "Outdoor Life," or "Sports Afield" magazines. Find Out More, p.342. Collect newspaper articles on shark attacks. List conditions that led up to the attack. Find Out More, p.343. Observe fish scales. See Investigate On Your Own, No. 1. p.382. Teaching Strategy for p.341, fish reports, T93. Read fish articles in outdoor magazines and describe how fish behavior attracts fishermen. Observe fish in aquarium and describe ways in which the body of the fish is adapted for movement.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	@Do library research on fish that show interesting and unusual adaptations or activities. For example, fish that are adapted for life in the depths of the ocean. The nature of sea horses, or the nest building of the stickle-back fish. Students who have been to Sea Arama may give oral reports on their experiences.
Describe characteristics of amphibians.	*Collect pictures of different amphibians. List characteristics of each. *Have students draw Figure 18-8 on p.349 on life cycle of frog. Investigate: How long does it take a newly hatched tadpole to grow into an adult frog? p.351. Find Out More, p.346. Find Out More, p.347. Activity No. 29: Structure and Function in Frogs, pp.87-90, Activity Booklet. Teaching Strategy for p.348, compare heart of fish and amphibian, T94. Teaching Strategy for pp.348-350, Effect of hormones on metamorphosis, T94.
Describe characteristics of reptiles.	Have students outline characteristics and names of reptiles from pp.350-356. Students can compare the characteristics of reptiles and amphibians, listing similarities and differences. *Have students make a poster or chart and cut out and paste samples of each type (alligator, crocodile, turtle, lizard, and snake). Some may wish to draw them.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Do It Yourself, Observe a reptile, p.355. Prepare reports on the significance of reptiles in maintaining a balance of nature. List the economic values of reptiles. Have the students research for extinct reptiles other than dinosaurs. Teaching Strategy for p.353, observing turtles, T95. Have students do research on poisonous snakes in your area and how to identify them. Note teacher's aide on pp.T95-96 *Prepare a chart showing the proper first aid treatment for a snake bite. Make a list of precautions that should be followed when hiking or camping in areas that are natural habitats for poisonous snakes. Have students do a report by going to the local zoo and interview the curator of the snake house about poisonous snakes and the use of their venom. Plan a trip to the Houston Zoo Reptile house. Teaching sayings that relate to coral snake identification: Red and yellow: kill a fellow (Coral) Red and black: friend of Jack (similar non-poisonous snakes) Students can do research on folklore relating to reptiles.

Chapter 19: Birds and Mammals

Advanced Preparations: None

Major Concepts to be taught:

- Life activities of birds
- Structure of birds
- The complex structure of mammals
- Examples of mammals

Instructional Objectives:

- The student should be able to -
 - Describe characteristics of birds.
 - Explain the difference between cold-blooded and warm-blooded organisms.
 - Describe characteristics of mammals.
 - Distinguish between different groups of mammals.

Assessment:

- The student will:
 - Identify characteristics that make birds suited for flight.
 - Determine the advantages that warm-blooded organisms have over cold-blooded organisms.
 - Trace the migratory patterns of different birds.
 - Explain why mammals are the most complex organisms on earth.
 - State characteristics that set mammals apart from all other groups of animals.
 - Identify examples of different kinds of mammals: egg-laying, pouched, rodent, carnivores, hoofed, and primates.
 - List the sea mammals and distinguish similarities and differences between the different sea mammals.

Materials:

Textbook: Exploring Living Things, pp.360-379
References: Teacher's Overview, pp. 197-101

Laboratory Investigations:

- Do It Yourself: Identify birds, p.366
- Activity No.30: A Small Mammal Maze, pp.91-92, Activity Booklet
- Investigate: How much oxygen does a small mammal use? p.368.
- Do It Yourself: Visit a zoo having sea mammals, p.376.

Films:

- 6086 - Adaptations of Birds, 11 minutes
- M7669 - Elementary Natural Science: Owls, 16 minutes
- M7670 - Elementary Natural Science: Song Birds, 13 minutes
- L7718 - Why do Birds Sing?, 27 minutes
- L7706 - Bird Brain: Mystery of Bird Navigation, 26 minutes
- M7299 - Flying Birds, 12 minutes
- M7513 - Flight of the Penguins, 25 minutes
- M2480 - Living Mammal, The, 17 minutes
- 3280 - Mammals and Their Characteristics, 11 minutes
- M7777 - Whales, 22 minutes
- L7709 - Dolphins and Men, 25 minutes
- M7765 - Return of the Sea Elephants, 20 minutes

Suggested Activities:

- Summing Up, p.378
- Checking Up, Vocabulary, p.378
 - Knowledge and Understanding, pp.378-379
 - Concepts, p.379
 - Application and Critical Thinking, p.379
- Doing More, Questions 1 and 2, p. 379
- Find Out More, p.362
- Find Out More, p.370
- Find Out More, p.375
- Teaching Strategy for pp. 361-362, T98
- Teaching Strategy for pp. 364-365, T98
- Teaching Strategy for pp. 361-366, T98
- Teaching Strategy for p. 366, T99
- Teaching Strategy for pp. 367 and 369, T99
- Teaching Strategy for p. 370, T99
- Teaching Strategy for p. 371, T99

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe characteristics of birds.	Read aloud Chapter 19, pp.360-365 about birds and answer questions as class discussions. Have students do library research reports on John James Audubon and his work on birds. Find Out More, p.362. Have students outline the characteristics of birds (p.363, Note the advantages of a four-chambered heart.) Have students do reports on aerodynamics and how a bird's body is adapted for flight. Note Figure 19-3 on p.363 as an aide. Have students draw maps or get maps from Audubon Society or Department of Parks and Wildlife and diagram the flights of different kinds of birds. Use library for references. Do It Yourself: Identifying birds, p.366. Teaching Strategy for pp.364-365, migratory birds, T98. Doing More, No. 1, p.379. Boil a chicken, remove the tissue and students can reconstruct the skeleton. Collect pictures of different kinds of bird beaks and feet. Students can guess the type of food and life style of each example. See Teaching Strategy for pp.361-362, T98. *Teaching Strategy for pp.361-366, build bird houses, T98. Doing More, No. 2, p.379.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Explain the difference between cold-blooded and warm-blooded organisms.	Compare the three chambered heart of a cold-blooded animal such as the frog, and a four chambered heart of a bird or mammal. See p.348. Discuss advantages of the four chambered heart over the three chambered heart. See Teaching Help for p.363, T97. *Using pp.84-88, make a chart listing the phylums of the cold-blooded animals and the phylums of the warm-blooded animals. Write the main differences between the body temperatures of cold-blooded and warm-blooded animals, and the advantages the warm-blooded animals have over the cold-blooded animals. Refer to p.361. Using references, students can look up body temperatures of different mammals and hypothesize reasons for the differences in temperatures.
Describe characteristics of mammals.	Read pp.370-373 and outline the characteristics of mammals and make comparisons to other phylums of the animal kingdom. Investigate: How much oxygen does a small mammal use? p.368. You may substitute a hamster for this. Activity No. 30: A Small Mammal Maze, pp.91-92, Activity Booklet. Make lists of what certain mammals may be used for. See Teaching Strategy for p.366, T99. Raise rodents (gerbils, hamsters, guinea pigs) in the classroom for observations. See Teaching Strategy for p.371, T99. @Research and give oral reports on "intelligent" mammals such as chimpanzees, dolphins and porpoises.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Locate references on the tracks of mammals. Prepare a chart showing the tracks of selected mammals and describe their life style. Look for information on making plaster of paris imprints of mammal tracks.
Distinguish between different groups of mammals.	*Have students copy list of mammals on p.369. Have them look for pictures to paste on a chart or to draw to illustrate the kinds of mammals. Read over pp.370-373 and outline the kinds of mammals and their characteristics. Take a trip to the zoo to see some of the varieties of mammals. Call Docent Society to come to your class and give a presentation (small mammals) to your classes. Find Out More, p.370. Teaching Strategy for pp.367 and 369, other groups of mammals, T99. Teaching Strategy for p.370, Discussion on egg-laying mammals, T99. Have students look up articles from the National Geographic magazines on mammals and do reports. *Make charts of the types of sea mammals and illustrate some whales, seals, walruses and dolphins. Take a trip to Sea Arama in Galveston and do reports on the sea mammals there.

UNIT 5

THE HUMAN BODY: A STUDY OF YOURSELF

Time Allotment
40 days for entire unit

Chapter 20: Protection, Support and Movement

Advanced Preparations:

1. Get food charts from Health Department on Basic Four Foods.
2. Check health stores for caloric charts on foods.
3. Check with Museum of Natural Science for use of models on the Human Body.
4. Check to see if you can get a dental hygienist or someone from the medical professions to come and talk to your students about good health and good eating habits, or care of the teeth.
5. Order beef hearts for demonstration in Chapter 22.
6. Order frogs if you wish to do frog dissection at the end of the system study, Chapter 24.

Major Concepts to be taught:

The purpose of the skin
The integral parts of the skin
The development of the skeleton
The development of muscles

Instructional Objectives:

The student should be able to -
Describe the structure and function of the skin.
Describe the structure and function of the skeleton.
Locate and name the major bones of the body.
Locate and name the major joints of the body.
Identify and locate the different types of muscle tissues.
Relate muscular contraction and relaxation to movement.

Assessment:

The student will:

- Identify the two layers of skin and compare the structures found in each.
- List four functions of the skin.
- E*Use an oral thermometer, obtain own body temperature. and decide if it is below normal, normal or above normal. Explain how the skin helps in maintaining body temperature.
- E*List four functions of the skeletal system. Explain the difference between cartilage and bone. Give the function of ligaments and cartilage.
- E*Name the bones that perform the functions of protection and movement. Match the scientific names of the bones to their location on a drawing of the skeleton. Explain the function of periosteum, red marrow, yellow marrow, bony layer.
- *Name the four types of joints and their location: hinge, ball and socket, immovable, and sliding joints.
- *Locate smooth, striated and cardiac muscles and identify whether or not they are voluntary or involuntary. Demonstrate with the skeleton how the bicep is attached and used for movement of the arm.
- E*List ways to help keep skin, skeleton and muscle tissue healthy or unhealthy.

Materials:

Textbook: Exploring Living Things, pp.386-403.
References: Teacher's Overview, pp.T103-107

Laboratory Experiments:

- Study of the Human Skeleton, p.393.
- Investigate: What can I observe about bones? p.396.
- Do It Yourself: Observe muscles contracting and resting, p.400.
- Investigate: How does perspiration, or sweat, help cool a person? p.390.

Films:

- M2295 - The Human Body: Muscular System, 14 minutes
- M4879 - Muscle Dynamics of Contraction, 21 minutes
- M2308 - Tissues of the Human Body, 16 minutes
- M4591 - About the Human Body, 15 minutes
- M3239 - Your Skin, 15 minutes
- M7312 - Human Machine, 13 minutes
- M7014 - About Your Body, II, 13 minutes

Suggested Activities:

Study of the Human Skeleton for the laboratory
Summing Up, p.402.

Checking Up: Vocabulary, p.402.

Knowledge and Understanding, p.403

Concepts, p.403

Application and Critical Thinking, p.403

Doing More, Questions 1 and 2, p.403.

Care of the Skin, p.40

Find Out More, p.389

Find Out More, p.392

Investigate On Your Own, No. 2, p.478

Teaching Strategy for p.387, T104

Teaching Strategy for pp.387-388, T104

Teaching Strategy for p.392, T105

Teaching Strategy for p.395, T105

Teaching Strategy for pp.398-399, T106

Teaching Strategy for pp.399-400, T106

Teaching Help for Doing More, No. 1, T107

In guide:

The Human Skeleton

The Skeletal System Information Sheet

The Skeletal System Worksheet

General Activities of Muscular Information Sheet

General Activities of Muscles Worksheet

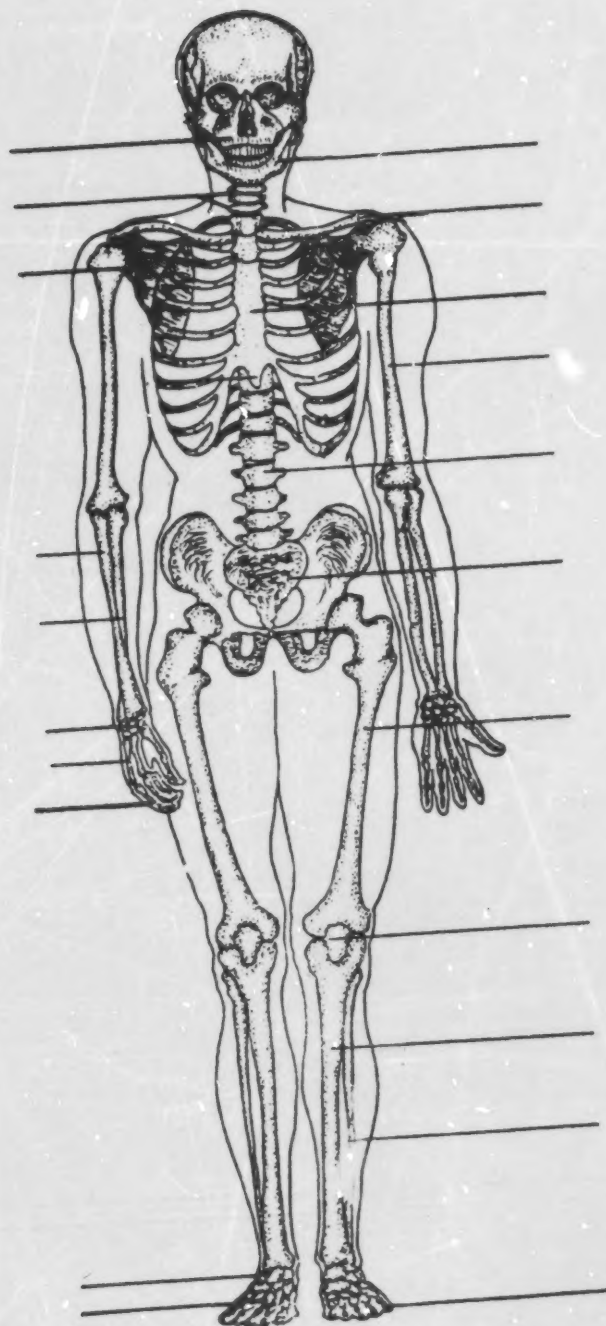
Chicken Wing Dissection

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the structure and function of skin.	*Read over pp.387-391. Outline the functions of the epidermis and then the dermis. *Copy diagram of skin on p.388 and label. Care of the Skin (Careers), p.401. See Teaching Helps for aid with this topic, T107. Students may observe skin cells in microscope, see Teaching Strategy for pp.387-388, T104. *Have students examine skin with a hand lens. Compare observations with drawing on p.388. *To show how sweat affects skin temperature, experiment with liquids such as water, alcohol, and acetone, allowing each to evaporate on the arm. Explain results and form conclusions, see Teaching Strategy, p.391, T104. E*Students can measure their own body temperatures using oral thermometers. (Order from central warehouse) They can record and compare temperatures taken when 1) in a sitting position, 2) after a small amount of movement, and 3) after running in place for a few minutes. Students can convert their body temperature from °F to °C. [$^{\circ}\text{C} = 5/9(^{\circ}\text{F} - 32)$] Using microscopes students may observe and compare different colored hairs, listing differences and similarities. Have students place a drop of iodine on palm, back of hand, and inside arm. Allow to dry, checking several times within two weeks. Students can record observations and conclusions. Which areas of skin wear away more quickly? Why?

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Find Out More, Skin disorders, p.389. Investigate: How does perspiration, or sweat, help cool a person?, p.390. *<u>Fingerprints</u>: Using ink pads or carbon paper, have students make fingerprints of thumb and fingers on each hand. They can make a chart for this and compare their prints with others in the class. A brief history of fingerprinting could precede this activity (one of the students could do the report.) See Teaching Helps for Doing More, No. 1, p. T107.
Describe the structure and function of the skeleton.	*Discuss and have students make predictions on what could happen if we did not have a skeleton. *Read over pp.391-400 and outline the four functions of the skeletal system. Investigate: What can I observe about bones? p.396 (Use Figure 20-4 on p.292 as an aide.) Find Out More, p.392. Teaching Strategy for p.392, examine prepared slides of bone, T105. Teaching Strategy for pp.392-394, skeleton functions, T105. Teaching Strategy for p.395, study cartilage, T105. Doing More, No. 3, Measure bones, p.403. *Anatomical comparison of skeleton: Compare the skeletons of a horse, cow, and human (or dog, cat and human). Note the differences and similarities. Give name of bone, location in body, length, width, outstanding characteristic, and main function of the bone for the particular animal.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	<u>*Measuring Games:</u> Students can measure in cm. their fingers, forearm, upper arm, and arm for length. A class profile could be done to show results. This activity could be used to show that anatomical structures in humans vary. Discuss injuries involving the skeletal system. Obtain old X-ray pictures from a doctor or hospital showing fractures. Have students think up other problems such as torn ligaments, dislocations, etc. Students can research diseases of the skeletal system (See Appendix) and give oral reports. To demonstrate mineral content of bone, students may soak a bone in vinegar for several days. Record observations and form conclusions. To demonstrate water content of bone, students may obtain a fresh bone, measure its weight in grams and record mass. Heat in an oven at 150° F (65°C) for several hours, cool, weigh again, record mass and explain observations.
Locate and name the major bones of the body.	Review the human skeleton from the laboratory. Have students copy the chart on p.393 and label all major bones or label prepared skeleton drawing (included in guide.) Distribute copies of The Skeletal System Information Sheet, in guide. Have students complete The Skeletal System Worksheet, in guide. Using X-rays, have students determine which bones are in the picture.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Students can discuss injuries involving the muscular system, such as: torn tendons, "charlie horses," sprains, etc. Students can search for and find tendons in their own bodies. Examples can be found easily in the neck, hand, and ankle. Distribute copies of General Activities of Muscles Information Sheet, in guide. Have students complete General Activities of Muscles Worksheet, in guide. Observe muscle tissue using a microscope. See Doing More, No. 2, p.403 and Teaching Strategy for pp.398-399, T106. To study voluntary and involuntary control of muscles, students can investigate the number of times they naturally blink in a minute and the number of seconds they can keep their eyes open without blinking. Make observations, collect data, compare results, and discuss how this exercise demonstrates voluntary and involuntary control.
Relate muscular contraction and relaxation to movement.	Do It Yourself: Observe muscles contracting and resting, p. 400. Students can do an activity to illustrate contraction, muscle fatigue and recovery: a) write name ten times as quickly as possible; b) make a fist and open hand alternately as many times as possible for one minute; c) write name ten times again. Observe results. Investigate On Your Own, No. 2, p.478. Teaching Strategy for pp.399-400, T106. A cumulative activity could be the dissection of a chicken wing. Students could locate, observe carefully, and describe the skin, muscles, ligaments, tendons, joints, and bones, included in guide.



THE SKELETAL SYSTEM

(Numbers in parenthesis are the numbers of that type of bone.)

1. Skull - cranium (8)
2. Spine (26)
 - a. Cervical vertebrae - (upper 7 vertebrae)
 - b. Thoracic vertebrae - (next 12 vertebrae)
 - c. Lumbar vertebrae - (next 5 vertebrae)
 - d. Sacrum - lower end of spine - (fused vertebrae) (1)
 - e. Coccyx - vestige of tailbone - (fused vertebrae) (1)
3. Bones of face
 - a. Mandible - lower jaw (1)
 - b. Maxilla - upper jaw (1)
4. Chest - 25
 - a. Sternum - breast bone (1)
 - b. Ribs - (24-12 pairs)
True ribs - (upper 7 pairs, attached to sternum)
False ribs - (5 pairs - Three pairs are attached to other ribs by cartilage)
Two pairs are floating - unattached to front.
5. Upper extremities
 - a. Clavicle - collar bones - (2)
 - b. Scapula - shoulder bone or shoulder blade (2)
 - c. Humerus - upper arm - (2)
 - d. Radius - thumbside of forearm - (2)
 - e. Ulna - otherside of forearm - (2)
 - f. Carpals - 2 rows at wrist - wristbone - (16)
 - g. Metacarpals - palm of hand - (10)
 - h. Phalanges - fingers, thumb - (28)
6. Lower extremities
 - a. Pelvic bones - hip - (2)
 - b. Femur - upper leg or thigh (2)
 - c. Patella - knee cap - (2)
 - d. Tibia - shin - (2)
 - e. Fibula - side of lower leg or calf - (2)
 - f. Talus - heel bone (2)
 - g. Tarsals - instep - (14)
 - h. Metatarsals - ball of foot - (10)
 - i. Phalanges - toes - (28)

Joints

1. Hinge - elbow and knee
2. Ball and socket - hip and upper arm and shoulder
3. Fixed - immovable - skull
4. Gliding - wrist
5. Partially movable - vertebrae

THE SKELETON

Give the scientific name:

1. Skull _____
2. Spine _____
 - (a) Upper 7 vertebrae _____
 - (b) Next 12 vertebrae _____
(serve as attachment for the ribs)
 - (c) Next 5 vertebrae _____
 - (d) Lower end of spine _____
(fused bones)
 - (e) Tail bone _____
3. Bones of the face _____
 - (a) Lower jaw _____
 - (b) Upper jaw _____
4. Breast bone _____
5. Ribs 12 pairs _____
 - (a) True ribs _____
 - (b) False ribs (5 pairs) _____
 - (c) Floating ribs (2 pairs) _____
6. Collar bone _____
7. Shoulder blade _____
8. Upper arm _____
9. Lower arm (thumb side) _____
10. Lower arm (opposite thumb) _____
11. Wrist bones (8 bones) _____
12. Palm of hand (5 bones) _____
13. Fingers and toes _____
(14 in each hand or foot)
14. Hip bone _____
15. Upper leg _____
16. Knee cap _____
17. Shin bone _____
18. Calf bone _____
19. Instep of foot _____
(7 bones in each foot)
20. Ball of foot _____
(5 bones in each foot)

THE SKELETAL SYSTEM

PURPOSE:

To develop understanding about the structure and functions of the human skeleton.

MATERIALS:

Model of human skeleton, charts, references

EXPLANATION:

The human skeleton has three primary functions: (1) to support the body and give it form; (2) to serve as an attachment for muscles; and (3) to protect the vital internal organs of the body. In addition to these functions, red blood cells are produced in the marrow of the long bones.

As you follow the various procedures of this experiment, be constantly aware of these functions, and note how the different bones and attaching tissues are modified for its work by being very hard. Note that ridges on the bones serve for attachment of muscles and that little holes indicate places where blood vessels and nerves enter the bones. Note also that some bones are round, some are flat, and some are hollow, depending on their function. You should attempt to identify each of these modifications and think about their importance to you as you carry on your daily life activities.

PROCEDURE I: A study of the Human Skeleton

Study the model of the human skeleton and the various charts that are available. Examine them carefully and note the following:

1. The bones of the skull are fused together for greater protection. The points of fusion can be identified by the wavy lines where the bones grew together.
2. There are five easily identified sections of the vertebral column. Count the vertebrae beginning at the skull, and locate the following:
 - a. The seven cervical vertebrae of the neck
 - b. The twelve thoracic vertebrae with pairs of ribs attached
 - c. The five lumbar vertebrae which allow man to bend his back
 - d. The five sacral vertebrae which are fused to the pelvic girdle
 - e. The four coccyx vertebrae which compose the "tail bone"

3. Note the different kinds of joints and identify at least one of each of the three basic types.
4. Find the two pairs of floating ribs and note how they are connected.
5. Observe carefully how the ribs are connected to the thoracic vertebrae and the sternum.
6. Notice the fused bones of the pelvis which provides a firm support for the body organs.
7. Observe the fingers and toes. Note that man has an opposable thumb for grasping.

PROCEDURE II: Location of Bones That Compose the Skeleton

Locate the bones of the human skeleton and label them on the drawing in Item 1, Observations and Conclusions: skull, superior maxillary, inferior maxillary, cervical vertebrae, clavicle, scapula, humerus, radius, ulna, ribs, sternum, carpus, metacarpus, phalanges (fingers), lumbar vertebrae, pelvic girdle, femur, patella, tibia, fibula, tarsus, metatarsus, and phalanges (toes).

THE SKELETAL SYSTEM

OBSERVATIONS AND CONCLUSIONS:

1. Label the drawing of the human skeleton on the following page.
2. Name the three kinds of joints and give an example of each.
3. What are the functions of the skeletal system?
4. Name the different groups of vertebral column and give the function of each.
5. Explain why the ribs are attached to the sternum by flexible cartilage.

QUESTIONS FOR RESEARCH:

1. What particular modifications of the human skeleton provide for protection of the vital organs?
2. How does man's skeletal system adapt him to perform his daily life activities?

GENERAL ACTIVITIES OF MUSCLES

PURPOSE:

To study some of the general activities of muscles

MATERIALS:

Strip of paper and scotch tape, ice cubes or a pan of ice, water, watch with a second hand

EXPLANATION:

One of the basic characteristics of animal life is the ability to change position. In mammals, this ability is solely the function of skeletal muscles. However, muscles are also essential for other vital processes. Smooth muscles are necessary to the functioning of internal organs, and cardiac muscles are responsible for pumping the blood through the circulatory system.

PROCEDURE I: General Activities of Muscles

1. Roll up your sleeve and have someone fasten a strip of paper firmly about your upper arm, over the bicep muscle while your arm is hanging loosely at your side. Now flex your arm strongly at the elbow and note what happens to the paper. Answer items 1 and 2, Observations and Conclusions.
2. Press the toes of your right foot firmly on the floor and raise yourself on that foot. At the same time feel the calf of your right leg. Note what happens to the muscle and the effect this movement has on the position of the heel of the foot. Feel the tendon that attaches the calf muscles to the heel when the foot is extended and when it is flexed at the ankle. Flex the foot sharply and feel the muscle on the front of the leg. Note what happens to it. Answer items 3 and 4, Observations and Conclusions.

PROCEDURE II: The Effect of Temperature on Muscular Contraction

1. While someone times you, write your name on a piece of paper three times at your normal speed. Record the average time on the chart in Item 5, Observations and Conclusions.
2. Immerse the hand in ice water for one minute, then write your name again three times. Record the time.
3. Warm your hand again by massaging it or by placing it in warm water until it returns to normal temperature; then write your name again three times. Record the results and answer Item 6, Observations and Conclusions.

PROCEDURE III: The Effect of Fatigue on a Muscle

1. Open and close your hand rapidly and forcefully, counting the number of times you can do this in 10 seconds.
2. Repeat this process ten times, keeping a record of the number of closures you make per trial. Plot these results on the graph in Item 7, Observations and Conclusions, and answer Item 8.

PROCEDURE IV: Isometric and Isotonic Contractions

When muscles are used for movement, they shorten. However, a muscle may perform work without changing length. In the first case, the muscle shortens but the tension of the muscle remains about the same. This is termed isotonic contraction. In the second case, the length of the muscle stays about the same but the tension increases sharply. This is called isometric contraction.

1. Rest the forearm on the table, palm up. Place on your palm a book that you can lift with one hand. Lift by flexing your forearm. Observe the upper arm muscles as they contract isotonically.
2. Rest the forearm on the table, palm up. This time place on the palm a weight too heavy to lift with one hand. Try to flex the forearm. Observe and feel the upper arm muscles as they contract isometrically.

PROCEDURE V: Structure of Muscle Tissue

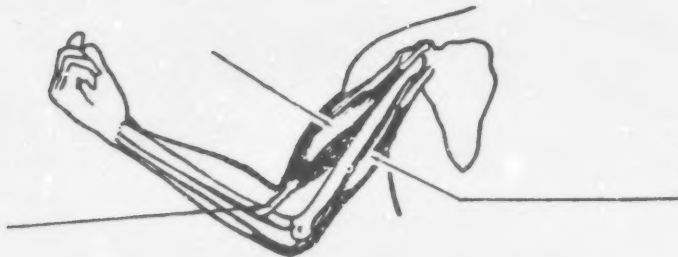
1. Examine a prepared microscope slide of skeletal muscle tissue, first under low power, then under high power. In longitudinal sections of muscle, the cells appear as long parallel cylindrical fibers of about the same size. Each fiber contains cross-striations, which are continuous alternate dark and light bands. The term striated muscle refers to this characteristic. Along the edges of each fiber are numerous oval nuclei that lie just inside an outer membrane of the fiber. Between fibers are nuclei of the connective tissue that binds fiber to fiber throughout the muscle.
2. Examine a prepared slide of smooth muscle. These cells are long and pointed at their ends. A single nucleus occupies the center of the cell. There are no cross-striations.
3. Examine a prepared slide of cardiac muscle. The cells of cardiac muscle are similar to skeletal muscle in that they have cross-striations, though not so definite. They differ in that the fibers branch and join other fibers. A nucleus in the cardiac muscle cells is in the center of the fiber rather than along the edge, as in skeletal muscle. Make the drawings indicated in Item 9, Observations and Conclusions.

GENERAL ACTIVITIES ON MUSCLES

OBSERVATIONS AND CONCLUSIONS:

1. Explain what happens to the bicep and tricep muscles when the arm is bent, and (2) when it is straightened.

2. Label the diagram below as follows: bicep, tricep, tendon.



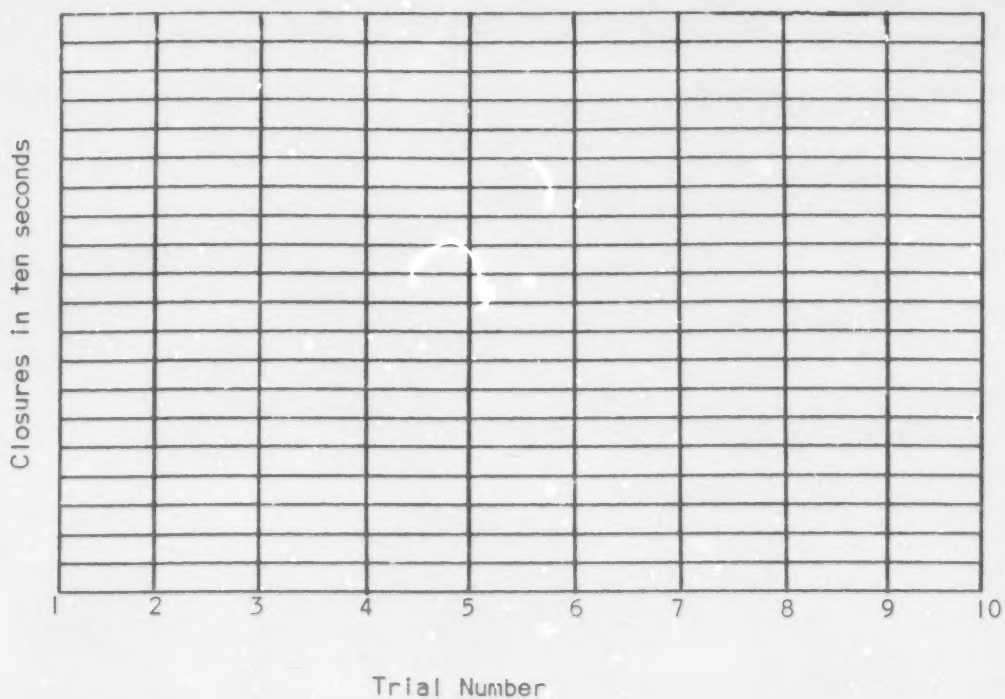
3. How is the calf muscle attached to the heel?
4. What is meant by antagonistic muscles? Give an example.

5. Record the time for writing your name three times in the following data table:

Muscle Condition	Time	Time	Time	Average Time
Normal				
Cold				
Warmed				

6. How does heat affect the control of a muscle? Why?

7. Make a graph showing the results of Procedure III.



8. What is the effect of fatigue on muscle control?

9. Make the drawings indicated below:

Skeletal muscle cells

Smooth muscle cells

Cardiac muscle cells

QUESTIONS FOR RESEARCH:

1. Make a list of common muscle diseases.
2. What can be done to repair strained or torn muscle tissue?

DISSECTION OF A CHICKEN WING

Purpose: To identify the tissues found in a chicken wing.

Materials: Two sheets of folded newspaper, two paper towels, chicken wing, balance, dissecting scissors, dissecting needle.

Procedure:

1. Place the two sheets of newspaper together and then fold them three times so that you will have a pad of newspaper approximately 25 cm by 40 cm. Place a paper towel on the pad of newspaper. This will serve as your dissecting pad. Do all of your dissecting over or upon this pad.
2. Cut a square from a second paper towel which is about ten centimeters on a side. Use a balance to determine the mass of this square. Add the chicken wing and determine the mass of the wing plus the square. Calculate the mass of the wing.

Data:

Mass of Square:	_____	g
Mass of Square plus wing:	_____	g
Mass of Wing:	_____	g

3. Carefully remove the skin from the wing. Begin by making a cut through the skin in the middle section and then carefully pull the skin away from the bone and muscle. Use the scissors to cut the places where the skin is attached. Note the points where the skin is attached and determine if it is attached to the muscle or bone.



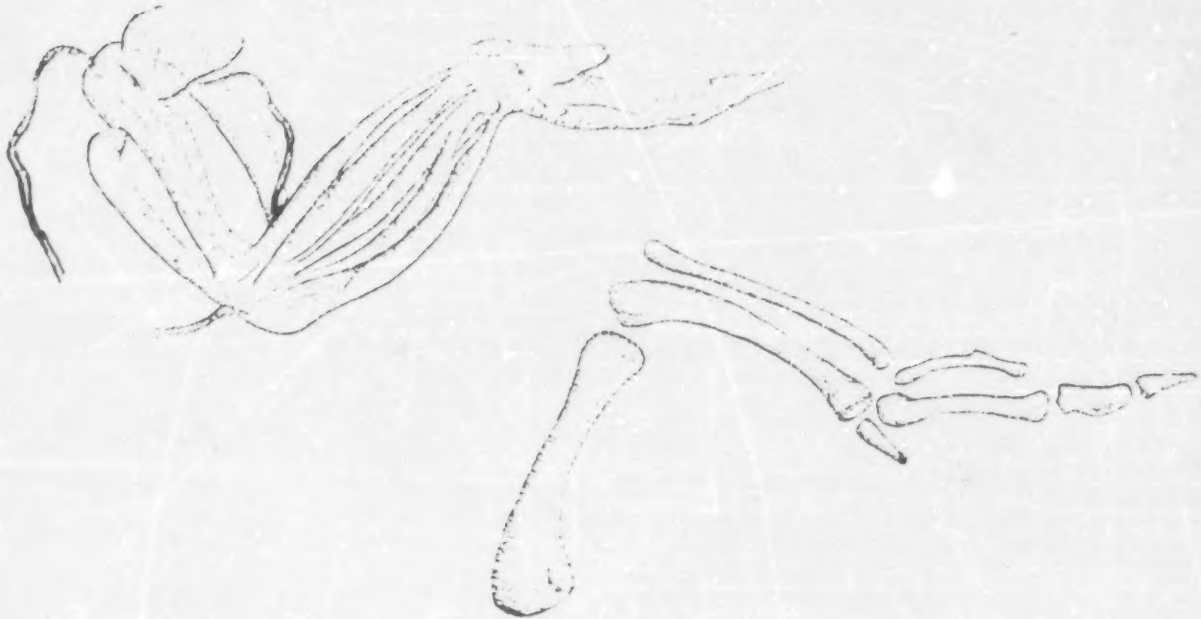
4. Place the skin upon the square of paper towel and determine the mass of the skin plus the square. Calculate the mass of the skin and the percentage of the mass of the skin is of the mass of the total wing.

Data:

Mass of Square plus Skin:	_____	g
Mass of Skin:	_____	g
Percent of skin in the wing:	_____	%

5. Identify the fatty tissues found in the various parts of the wing. It will be yellowish in color. Take a small clump of the fat and use your finger to press it against a portion of the paper towel.

6. Use the pointed end of the scissors and the dissecting needle to separate the muscle tissues from each other. Do not remove the muscles from the bone at this point.
7. Dissect out a nerve and a blood vessel. The nerve will be white and about one millimeter in diameter; it will likely be in the upper wing section between the muscles and near a bone. The blood vessel will be dark because the blood will have coagulated.
8. Locate the ligaments and tendons. Ligaments are tough white tissue which holds the bones together; tendons attach the muscles to the bones.
9. Remove the muscle tissue, nerve and blood vessel from the bones. Look at the joints.
10. Separate the bones at the joints.



Questions:

1. What type of tissue is the skin?
2. List the types of connective tissue seen in this dissection.
3. What part of the chicken is generally called "meat" ?
4. Why is a person who needs to lose weight told not to eat the skin of a chicken?
5. Compare the bones found in a chicken wing with those found in a human arm.

Chapter 21: Digestion and Excretion

Advanced Preparations: None

Major Concepts to be taught:

Development of food materials for the body
Development of structure and function of digestive system
Development of structure and function of the excretory system

Instructional Objectives:

- The student should be able to -
- Identify the foods necessary for the body's needs.
 - Describe the relationship between Calories and the amount of food that should be eaten to supply the body's daily needs.
 - Describe the structures and functions of the digestive system.
 - Describe the structures and functions of the excretory system.
 - Apply sensible daily habits to maintain a healthy digestive and excretory system.

Assessment:

- The student will:
- Identify and write examples of the following nutrients necessary for the body: carbohydrates (starch and sugar), proteins, fats, vitamins, minerals, and water.
 - Identify the purposes of these nutrients in the body.
 - @Define a Calorie and calculate the number of Calories obtained in a meal.
 - *Name the basic food groups and design a menu showing a balanced diet.
 - Recognize problems that can occur if a proper diet is not maintained.
 - E*Identify the function of the digestive system.
 - E*Identify major organs of the digestive system.
 - Use the torso model to locate the stomach, esophagus, small intestine, salivary glands, liver, gall bladder, pancreas, and large intestine.
 - Trace a piece of meat in the path through the digestive tract.
 - *Match the digestive system organs to their functions.
 - Name the small finger-like projections of the small intestine and give their function.

- Name where digestion starts.
 Identify the locations of carbohydrate, protein, and fat digestion and identify the end products of each.
 *Observe, collect data, and interpret experiments that are related to digestion.
 E*Identify the function of the excretory system.
 E*Identify the major organs of the excretory system.
 Name the waste products released by the lungs, kidneys, sweat glands and large intestine.
 E*List things that can be done involving digestion and excretion that can help a person to stay healthy or unhealthy.

Materials:

Textbook: Exploring Living Things, pp.404-419
 References: Teacher's Overview, pp. T107-T11

Laboratory Experiments:

- Do It Yourself: Count the number of Calories you use, p.410
 (Use Basic Foods Chart and incorporate balanced diets here.)
 Investigate: How does saliva help digest carbohydrates?
 p.412.
 Activity No. 31: Testing for Vitamin C., pp.93-96, Activity Booklet
 Activity No. 32: Enzymes and Digestion, pp.97-100, Activity Booklet

Films:

- M2929 - How the Body Uses Energy, 15 minutes
 M2104 - Digestive System, 14 minutes
 7430 - Nutrition: All American Meal, 11 minutes

Suggested Activities:

- Keeping Teeth Healthy, p.417 (Use Teacher's aides on T110.)
 Summing Up, p.418
 Checking Up: Vocabulary, p.418
 Knowledge and Understanding, pp. 418-419
 Concepts, p.419
 Application and Critical Thinking, p.419
 Doing More, Questions 1 and 2, p.419
 Find Out More, p.406
 Find Out More, p.413
 Find Out More, p.416
 Do It Yourself, Prepare a report, p.416
 Teaching Strategy for pp.405-407, T108
 Teaching Strategy for pp.407-409, T108
 Teaching Strategy for p.509, T108
 Teaching Strategy for pp.410-413, T109

In guide:

Digestion: Dissolving Time
The Digestive System Chart
Enzymes Related to Digestion Chart
Study Sheet on Digestion
The Digestive System Information Sheet
The Digestive System Worksheet

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Identify the foods necessary for the body's needs.	*Read Chapter 21, pp.404-409. Outline the names of the nutrients of the body and their function: carbohydrates (starch and sugar), protein, fat, minerals, and vitamins. *Have students copy the Daily Food Guide on pp.407-408 and plan a daily menu with a balanced diet. Find Out More, p.406. Teaching Strategy for pp.405-407, collect and analyze food labels, T108. Teaching Strategy for pp.407-409, study menus, T108 *Students may check the cafeteria menu to see if it has the kinds of foods needed for a balanced diet. Teaching Strategy for p.409, plan family meals, T108. Activity No. 31: Testing for Vitamin C, pp.93-96, Activity Booklet. Have a student report on Linus Pauling and the pros and cons of using Vitamin C to prevent colds. Have the students make a list of all foods eaten the previous day. Make a chart showing which foods were animal or plant tissue, products of animal or plant tissue, a sugar, starch, protein, or fat. Students can make checks in the proper column. *Have students list as many snack foods as they can and classify the foods as sugar, starch, protein, or fat.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Keep a list of different junk foods on the board for a week. Each day count the number of students who ate one or more of those foods. Have students research and report on low-calorie diet foods. Make a display of labels and ads. Have students make a collection of false ideas about foods and discuss in class. Examples: fish is brain food, brown eggs are healthier than white eggs, etc. @Students may research and make a chart of the major minerals showing what each does; e.g.: iron....blood potassium...nerve transmission calcium...bone To demonstrate the mineral content of food have students burn small quantities of various foods on an asbestos-centered gauze or some other support. @Students may research and prepare a graph showing the level of protein eaten by various peoples of the world. *Have students test for starch using iodine solution. Use cornstarch as a control and several samples of foods for test purposes. *Have students do Benedict's test for monosaccharides. Use glucose as a control. Students can test fruits, etc. Have students test for protein with nitric acid (VERY CAREFULLY) or Biuret reagent. Use egg white or gelatin as a control. *Have students test for fats by masking a piece of food between two layers of paper. The "greasy" spot indicates fat. The bigger the spot, the greater the amount of fat.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the relationship between Calories and the amount of food that should be eaten to supply the body's daily needs. Describe the structures and functions of the digestive system.	Have students read over p.409 and have class discussion on what a "Calorie" is and how it is calculated in daily food intake. Use chart of Figure 21-5 as a guide. Do It Yourself: Count the number of Calories you use, p.410. @Students can look up how to build a simple calorimeter and run tests to measure Calories on some easily burned foods like marshmallows and peanuts. Have students read over pp.410-415. Make copies of the "Digestive System," "Study Sheet on Digestion," and "Enzymes Related To Digestion." Use as a hand-out for students' review, or use as a worksheet and laboratory exercise, or use as a test. These activities are excellent materials for making the lesson easier to learn and study. Students are very receptive to handouts. Optional activities included in guide are: The Digestive System Information Sheet The Digestive System Worksheet Use the charts and torso model. E*Students can make a chart listing the organs of digestion and their functions. Students with a "love" for cars can compare their body metabolism to that of a machine. "Grab-bag" Game. Put the parts together on the bulletin board. Have a few questions available for each organ. This bulletin board could then be completed by putting drawings of the food groups near the location where they are broken down.
257	Teaching Strategy for pp.410-413, digestion reports, T109.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	*Investigate: How does saliva help digest carbohydrates?, p.412. Activity No. 32: Enzymes and Digestion, pp.97-100, Activity Booklet. Doing More, No. 1, p.419, demonstrate protein digestion. *Students can demonstrate the emulsification of fats by setting up a control test tube of water and oil, and a test tube of water, oil, and bile salts. Shake, observe, compare. Find Out More, p.413. *To demonstrate the function of the folded lining of the intestine, have the students design an experiment comparing the absorption ability of a straight length of paper towel or a folded towel of the same length. Research and oral reports may be done on different diseases affecting the digestive tract. (See Appendix for list.)
Describe the structures and functions of the excretory system.	E*Using the torso model, locate organs of the excretory system. Have students use Figure 21-9 on p.416 as a guide. E*Students could make a chart showing the four excretory organs (lungs, skin, kidney, large intestine), name the waste product produced, and tell what the waste is composed of. Write the American Kidney Foundation or American Cancer Society for bulletin board information. Do It Yourself: Prepare a report (urinalysis) p.416.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Find Out More: Problem on kidney dialysis machines on p.416.
Apply sensible daily habits to maintain a healthy digestive and excretory system.	Students are interested in learning about ulcers. Have either the school nurse talk to them or send for information to the Health Department. Write to Health Services for information about careers. Keeping Teeth Healthy (Careers) on p.417. Use Teacher's aid on p. T110. Teeth and dental care: The American Dental Association has many good pamphlets on dental care and is vitally concerned about this care in teenagers. Invite a dentist or dental hygienist to visit the classes. @Students may do research on health problems caused by vitamin and mineral deficiencies. @Students could do individual research on the various laboratory tests done on urine and feces; such as "sweat test" for cystic fibrosis. THIS WOULD REQUIRE OUTSIDE HELP. E*During the study of this chapter, the students should become aware of daily needs pertaining to diet, exercise, rest, environmental conditions, and the relationship of these to good health. E*Students can analyze their own environment, listing good and bad daily health habits (they may include their family if possible). They should decide how to improve any undesirable condition. This would be a good time to have the students write down everything they eat for one day over a period of a week. They can look for "empty calories," wasted food intake, etc.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Students should know that any individual, no matter how well disciplined, will fall short in certain areas of health maintenance. All home environments can be improved to some extent.

DIGESTION: DISSOLVING TIME

Lab Activity

Problem:

The necessity of chewing food in order to aid in the digestion process

Materials:

100 ml beakers (2)

warm water

rock salt crystals

Procedure:

Place two identical 100 ml beakers side by side. Fill each with warm water of the same temperature and amount. Using two small rock salt crystals (about the same size) carefully crush one, being sure to retain all particles.

Drop the intact crystal in one beaker and the crushed crystal in the other beaker *at the same time*. Time each beaker as to how long it takes the salt to dissolve.

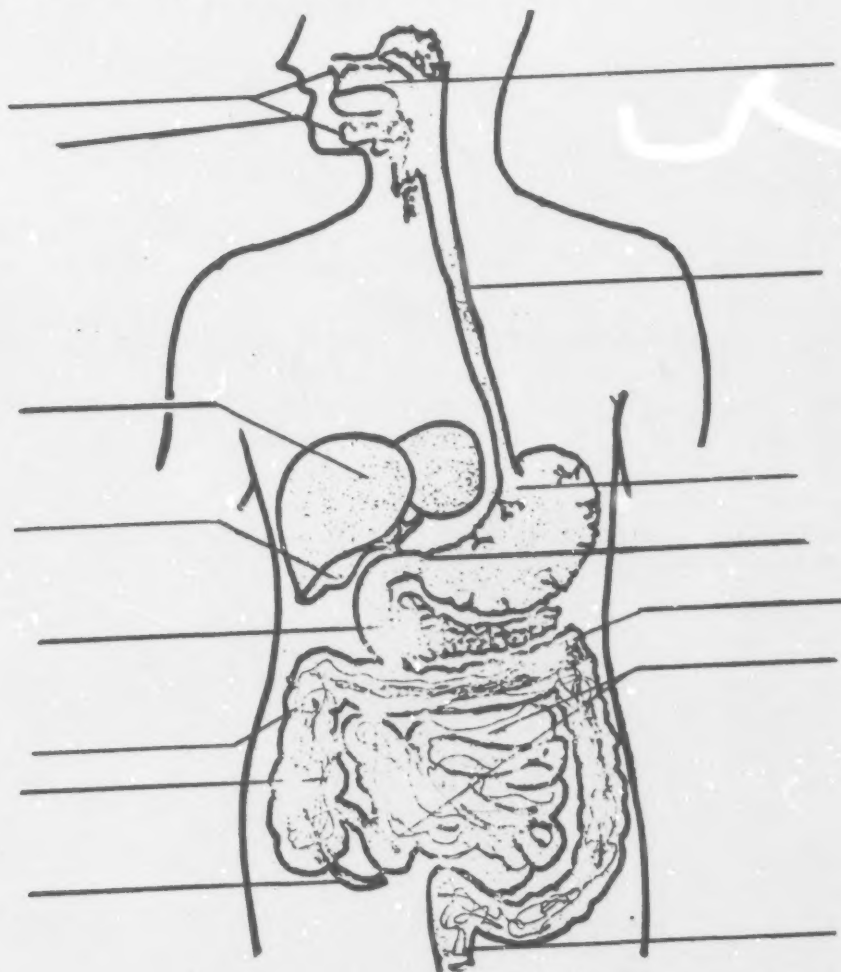
Alternate Procedure

Repeat using cold water. Compare results.

THE DIGESTIVE SYSTEM

OBSERVATIONS AND CONCLUSIONS:

I. Label the diagram of the human digestive tract below:



The Alimentary Canal

II. Trace the passage of food in the digestive system from the mouth to the rectum by re-arranging the list below in the proper sequence or order. There are eight words or steps in the correct answer.

Choices:

mouth
bile duct
trachea
pancreas
spleen
stomach
epiglottis

esophagus
duodenum
large intestine
rectum
small intestine
pylor
liver

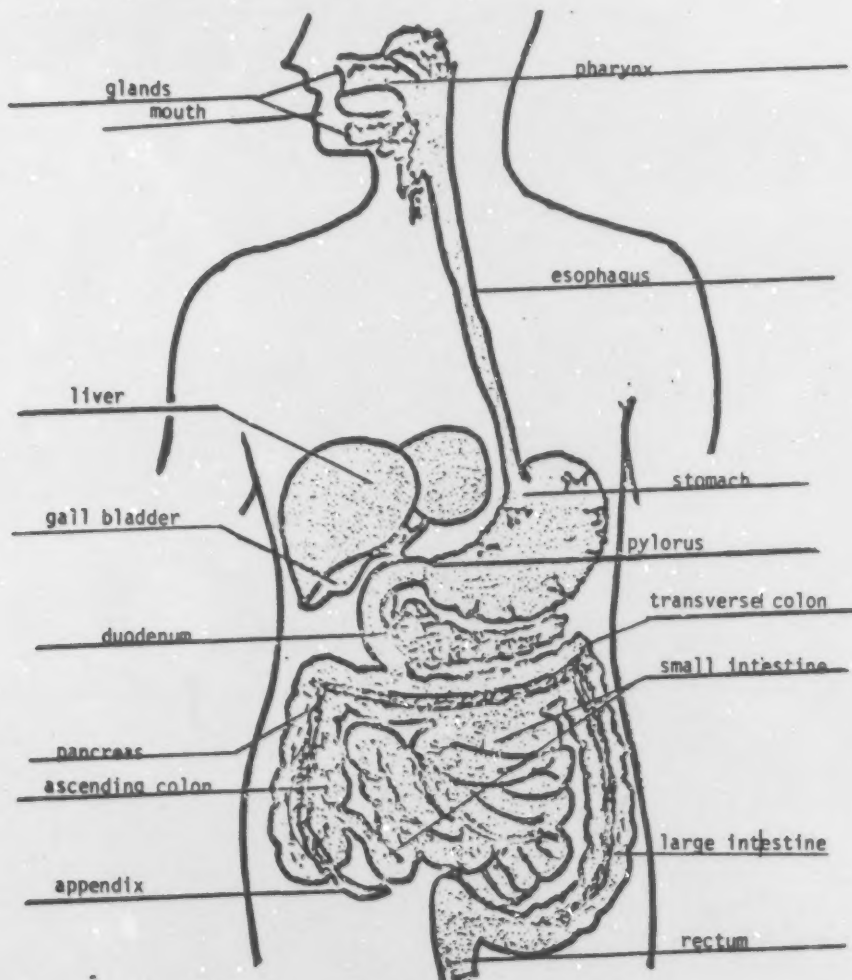
1. _____
2. _____
3. _____
4. _____

5. _____
6. _____
7. _____
8. _____

THE DIGESTIVE SYSTEM

OBSERVATIONS AND CONCLUSIONS:

I. Label the diagram of the human digestive tract below:



The Alimentary Canal

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Choices:

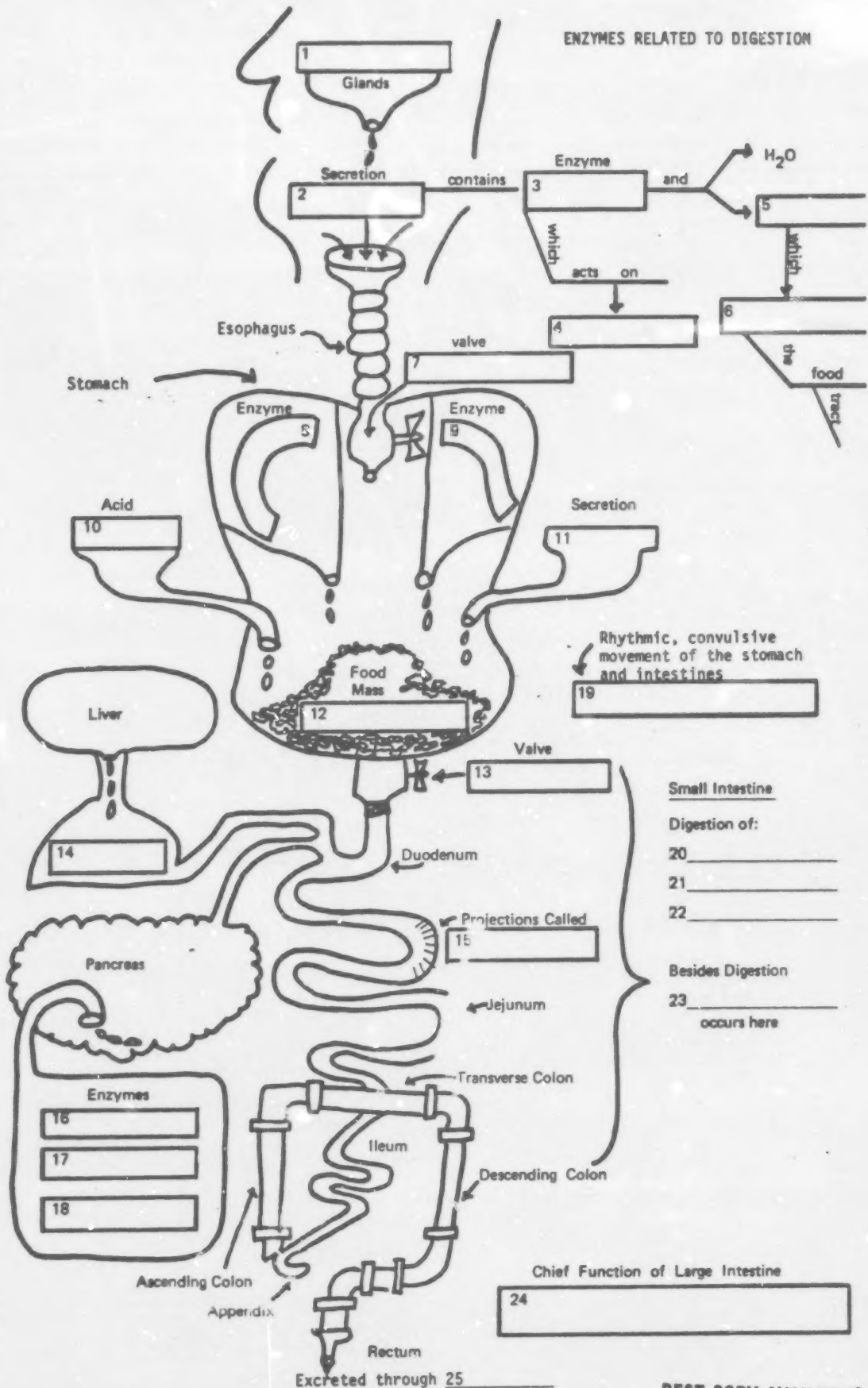
mouth
bile duct
trachea
pancreas
spleen
stomach
epiglottis

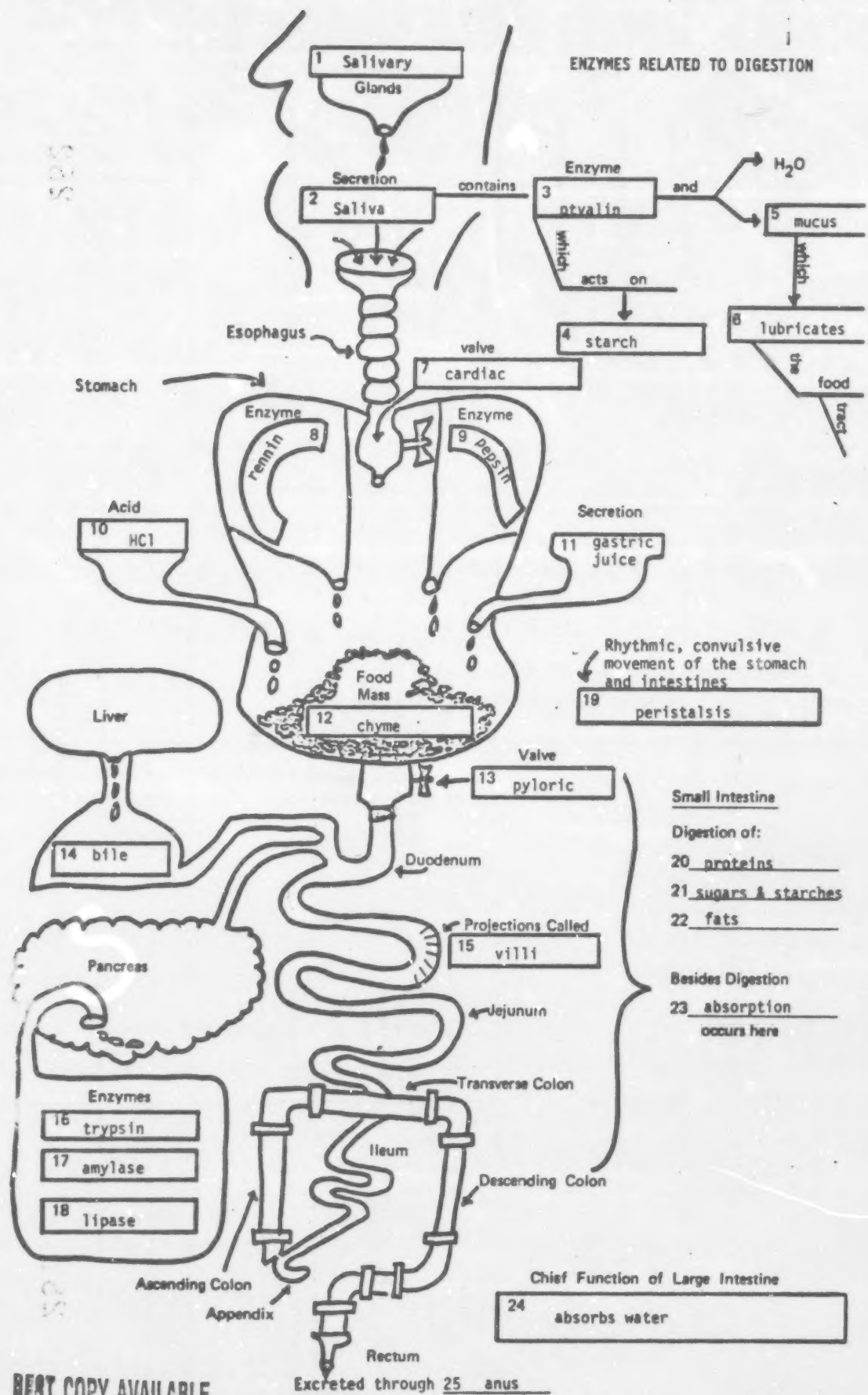
esophagus
duodenum
large intestine
rectum
small intestine
pylorus
liver

1. mouth
2. esophagus
3. stomach
4. pylorus

5. duodenum
6. small intestine
7. large intestine
8. rectum

ENZYMES RELATED TO DIGESTION





Alimentary Tract	Glands	Secretions	Enzymes	Functions or Actions
Mouth Digestion Begins Food is broken up	Salivary Parotoid Submaxillary Sublingual	Saliva	Ptyalin Maltase	Carbohydrate Digestion Begins Starch changed to sugar Acts on the sugar, maltose
Pharynx				Connects mouth to esophagus Epiglottis closes trachea to prevent food particles from entering respiratory tract.
Esophagus (Oesophagus)				Tube connecting pharynx with stomach
Stomach Two Valves: Cardiac Pyloric (or Pylorus)	Glands in lining of stomach	Gastric Juices & Hydrochloric Acid (HCl)	Pepsin Renin	Cardiac Valve-prevents food (chyme) in most cases from passing again to esophagus. Digestion of Protein Begins- Stops action of ptyalin and assists in breakdown of cellulose- <u>Carbohydrate Digestion Stops</u> Food remains in stomach 3 or 4 hours where it is crushed by peristalsis Pyloric Valve-prevents chyme from reentering stomach from small intestine.
Small Intestine Duodenum Jejunum Ileum	Pancreas Liver Intestinal Wall Glands	Pancreatic Juice Bile Digestive Juice	Trypsin Amylase Lipase	Digestion of protein completed-Digestion of fats & oils Acts on Proteins-changed to amino acids Acts on Carbohydrates-changed to simple sugar Acts on Fats-changed to fatty acids and glycerin Helps in digestion of fats-helps prevent decay of intestinal contents Aids digestion of proteins, carbohydrates & fats
Large Intestine Ascending Colon Transverse Colon Descending Colon	Appendage at junction of small intestine and large intestine is the Appendix.			Absorption of Food-occurs mainly in small intestine Villi-projections that increase surface area
Rectum				Tract leading to rectum where feces is expelled through anus. Excretory functions
Anus				
281	STUDY SHEET ON DIGESTION			282

THE DIGESTIVE SYSTEM

PURPOSE:

To learn about the various structures involved in the digestive process, and to learn the functions of each

MATERIALS:

Nystrom Chart No. 4, human torso, colored pencils, available references

EXPLANATION:

Although the human digestive system is complex as to its structure and functions, it can be conveniently grouped into the following four divisions:

1. Mouth and salivary glands: The principal glands of the mouth are the salivary glands, of which there are three pair. The largest, the parotid glands, are located beneath the ears on each side of the head, and the ducts open opposite the second upper molars. The submaxillary glands lie within the angles of the lower jaw. The sublingual glands lie beneath the tongue. Each of these glands secrete saliva, a thin, alkaline fluid containing water, mucus, and the enzymes ptyalin, which changes some starches to sugars. This action is very slight, since the food remains so short a time in the mouth. The steps of the digestive process that occur in the mouth can be outlined as follows:

- a. Food is mechanically crushed by the teeth.
- b. Food is moistened for tasting and swallowing by the water and mucus of saliva.
- c. Some starch is changed to sugar by ptyalin.
- d. Some soluble mineral matter is dissolved in the water of the saliva.

2. Pharynx: The pharynx connects the mouth with the esophagus.



3. Esophagus (gullet) and stomach: Passing from the mouth, the food enters the esophagus, which is from nine to twelve inches long. The esophagus enlarges into the stomach at the cardiac valve. The stomach is located just beneath the diaphragm, with the inlet at the left and close to the heart. Except when full, it is not the smooth, pear-shaped organ usually pictured. It may be collapsed and empty, depending upon its contents and muscular movements. The walls of the stomach are provided with millions of simple glands which secrete gastric juices. This digestive juice contains hydrochloric acid and two enzymes, rennin and pepsin. The stomach, therefore, performs the following functions.
 - a. It acts as a reservoir for food until partially digested.
 - b. It mechanically crushes and separates food particles by muscular movements known as peristalsis.
 - c. Rennin curdles the casein in milk (only in babies).
 - d. Pepsin acts on some protein.
 - e. Hydrochloric acid kills many bacteria and dissolves minerals.
4. Small Intestine: The stomach connects with the small intestine by way of a muscular valve, the pylorus. The pylorus prevents the food (chyme) from passing through before it is thoroughly crushed by digestive tract, consists of a coiled tube about twenty-five or thirty feet long. The first twenty to twenty-five feet, connected to the stomach, is called the small intestine, which is further sub-divided into the duodenum, the jejunum, and the ileum. Peristaltic action mixes and separates the food and keeps the food moving constantly through the digestive canal. To provide the fluids for digestion in the small intestine, there are three kinds of glands secreting alkaline digestive juices:
 - a. The pancreas secretes the pancreatic juices which act on all types of food except insoluble mineral matter.
 - b. The liver secretes bile, which is partly a waste that is constantly removed from the blood. It aids in the digestion and absorption of fats, stimulates the action of the intestine, and tends to prevent decay of intestinal contents.
 - c. Intestinal glands secrete intestinal juice. Intestinal juices act on most kinds of foods except fats and insoluble mineral matter.

The final digestion of food takes place in the small intestine. The general purpose of digestion is to change the foods into a soluble form so that they may pass through the body's membranes by absorption. Absorption may take place directly into the blood capillaries from the walls of the stomach and intestine, or indirectly by way of the lymph capillaries of the villi (often called lacteals) which eventually empty into the blood stream. All the steps of digestion and absorption lead to the final processes of assimilation and oxidation; that is, building protoplasm and using

food as fuel. Briefly, we can summarize the functions of the small intestine as follows:

- a. Further mechanical action by peristalsis
 - b. Final digestion of sugars, starches, proteins, and fats
 - c. Absorption of soluble food into the blood system
5. Large Intestine: The small intestine joins the large intestine at the lower right side of the abdomen, where there is a small appendage called the appendix. The inflammation of this organ is called appendicitis. The large intestine is shaped like an inverted "U" and is divided into ascending colon, transverse colon, and descending colon. By the time the food reaches the large intestine, most of its useful substances have been absorbed and only useless materials (feces) remain. They move slowly toward the rectum and are eliminated through the anus.

The whole of the food tube-esophagus, stomach, small intestine, large intestine, rectum, and anus-is generally referred to as the alimentary canal.

PROCEDURE:

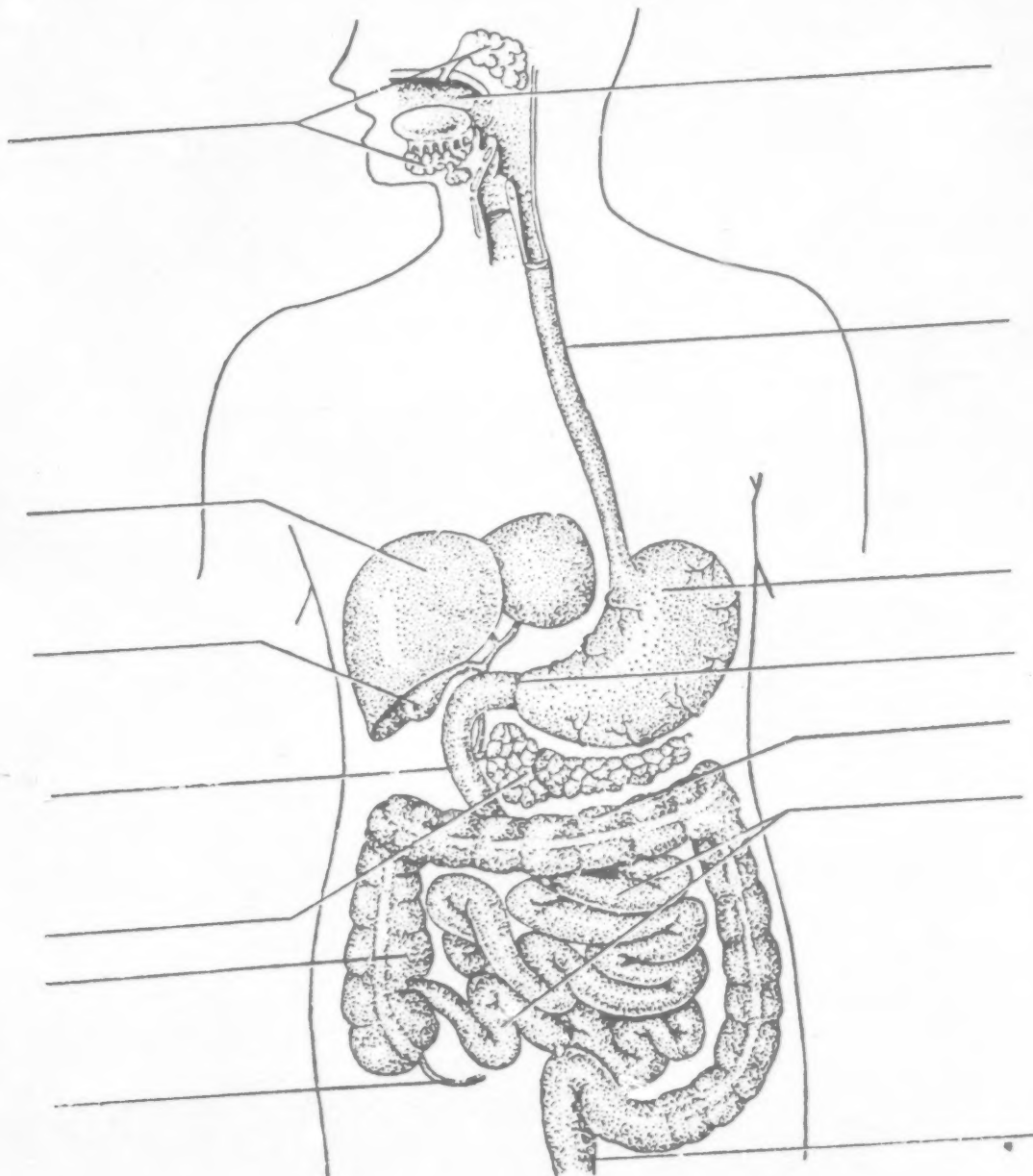
Study the Explanation and observe the principal parts of the human digestive system as shown on Nystrom Chart No. 4. Label the diagram in item 1, Observations and Conclusions.

Study the drawing of the villi as shown on Chart SC 31 and Nystrom Chart No. 6. Label the diagram in item 2, Observations and Conclusions.

THE DIGESTIVE SYSTEM

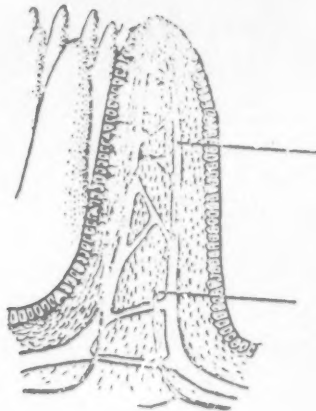
OBSERVATIONS AND CONCLUSIONS:

1. Label the diagram of the human digestive tract below:



The Alimentary Canal

2. Label the following diagram of a villus:



A Villus

3. Complete the following chart:

Gland	Fluid Secreted	Kind of Food Acted On
salivary		
gastric		
liver		
pancreas		
intestinal		

4. Complete the following chart:

Kind of Food	Organs Where Digestion Occurs	Name of Gland(s) Producing Enzymes
Carbohydrates		
Proteins		
Fats		

5. Define digestion and summarize how man is adapted to carry out this function.

QUESTIONS FOR RESEARCH:

1. Consult your teacher and the librarian for references on the digestive system. Learn about the enzymes which act on foods in the various organs. Make a chart similar to the one in Item 4, Observations and Conclusions, and add two more columns: Enzymes Secreted and Result of Enzyme Action.
2. What causes an "upset" stomach?
3. What are some of the common diseases of the digestive system?
4. Make a list of practices which can help to keep the digestive system healthy?

Chapter 22: Respiration and Circulation

Advanced Preparation: None

Major Concepts to be taught:

The development of the respiratory system
The development of the circulatory system
The development of blood

Instructional Objectives:

The student should be able to -

Respiration:

Explain why breathing is important and how it is different from respiration.

Describe the structures and functions of the respiratory system.

Associate environmental conditions and personal habits with respiratory health

Circulation:

Describe structures and functions of the circulatory system.

Identify the composition and function of the parts of the blood.

Identify the blood types.

Recognize how the lymphatic system aides the body.

Describe health problems and explain ways to avoid damage of the circulatory system.

Assessment:

The student will:

Respiration

E*Identify the function of the respiratory system.

E*Identify the major organs of respiration.

Define breathing and respiration.

Use the torso model to locate the lungs, trachea (wind-pipe), larynx, epiglottis, bronchi, diaphragm, and alveoli (air sacs) and give the function of each.

*Name the gases that are exchanged in breathing.

List three functions of the nasal passage.

E*List ways a person can help keep the respiratory system healthy or unhealthy.

Circulation

- E*Identify the function of the circulatory system.
- E*Identify the major organs of the circulatory system.
 - Label the major chambers of the heart.
 - Predict what could happen if a heart valve became damaged.
- @Trace a drop of blood as it flows from the vena cava through the heart to the lungs, back to the heart and out to the body.
 - Name the three kinds of vessels and give their functions.
 - Name the parts of the blood and give a function of each.
 - Name some of the diseases of the circulatory system.
 - Locate a pulse and count his own pulse rate.
 - Identify the four blood types and Rh factor.
 - Identify the function of the lymph nodes.
- E*list ways a person can help keep the circulatory system healthy or unhealthy.

Materials:

Textbook: Exploring Living Things, pp.420-435

References: Teacher's Overview, pp. T11-115

Laboratory Experiments:

- Do It Yourself: Measure your rate of breathing, p.422.
- Do It Yourself: Find out your breathing capacity, or vital capacity, p.424.
- Activity No. 34: Rate of Human Heartbeat, pp.103-106, Activity Booklet
- Activity No. 33: Physical Activity and Carbon Dioxide, pp.101-102, Activity Booklet.
- Investigate: How can you observe blood cells? p.431.
- Do It Yourself: Find the rate at which your heart pumps, p.426.

Films:

- L1672 - Hemo, The Magnificent I, 26 minutes
- L1673 - Hemo, The Magnificent II, 26 minutes
- M7015 - About Your Body II, 12 minutes
- 6226 - Heart and Circulatory System, 11 minutes
- 7695 - Circulatory System, 7 minutes
- L3738 - Story of the Bloodstream, 24 minutes
- M4315 - Breath of Air, 21 minutes
- M7396 - Lungs and the Respiratory System, 17 minutes
- 7684 - Respiratory System, 9 minutes
- 7732 - Lungs: An Inside Story, 10 minutes
- M7559 - Your Voice and Its Speech Helpers, 15 minutes

Suggested Activities:

Summing Up, p.434
Checking Up: Vocabulary, p.434
 Knowledge and Understanding, p.435
 Concepts, p.435
 Application and Critical Thinking, p.435
Doing More, Questions 1 and 2, p.435
Find Out More, p.421
Find Out More, p.426
Find Out More, p.432
Teaching Strategy for p.421, T112
Teaching Strategy for pp.421-422, T112
Teaching Strategy for pp.422-424, T112
Teaching Strategy for p.425, T113
Teaching Strategy for pp.429-432, T115
Teaching Strategy for pp.430-432, T115

In guide:

The Human Respiratory System Information Sheet
The Human Respiratory System Worksheet
The Respiratory System
The Human Circulatory System Information Sheet
The Human Circulatory System Worksheet
Composition of Blood Information Sheet
Blood Typing Experiment

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	
Explain why breathing is important and how it is different from respiration.	*Read Chapter 22, pp.420-424. Outline the purpose of oxygen in oxidation of food in the cells. Refer back to Chapter 21 on Digestion. Explain how breathing just involves taking in oxygen and giving off carbon dioxide. Do It Yourself: Measure your rate of breathing, p.422. Teaching Strategy for pp.421-422, Observe respiratory system, T112. @Demonstrate respiration by using chemical formulas. $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$ Students can show H_2O is produced by breathing onto a mirror. To show that CO_2 is produced, follow procedures in Teaching Strategy for pp.421-422, T112. Activity No. 33: Physical Activity and Carbon Dioxide, pp.101-102, Activity Booklet. Distribute copies of The Human Respiratory System Information Sheet, in guide. Have students complete The Human Respiratory System Worksheet, in guide.
Describe the structures and functions of the respiratory system.	*Make copies of the worksheet, "The Respiratory System," as a handout to students to fill in the blanks and color. *Copy diagram on page 423, color and label all parts of the respiratory system. Make a chart listing the organs of the respiratory system and a function of each. Do It Yourself: Find out your breathing capacity, p.424. Doing More, No. 1, Demonstrate diaphragm function, p.435.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Associate environmental conditions and personal habits with respiratory health.	*Invite someone from the American Red Cross or Fire Department to demonstrate and explain "mouth-to-mouth resuscitation." Film: <u>A Breath of Air</u> or any other films on smoking. Students can write to the American Cancer Society or the TB Association for information. Have students list reasons why the cigarette companies put a warning on their packages. *Do research on the miner's black lung disease or any type of occupation involving a polluted environment. *<u>Scotch Tape Lab</u> "Pollution is a Sticky Subject!" Put a mark on the non-sticky side of a piece of tape (the mark should be about 1/2 cm.) Expose the "sticky" side of the tape to the outside environment where particles can readily adhere to it for a few days. In the laboratory, students can look at the section of tape under the microscope, observe and report what they see. Call attention to the Heimle technique used for "Cafe Coronaries" (a plugged up windpipe) and CPR as methods for restoring respiration and heart beat. Stress respiratory safety when working with paint spray, grain dust, and other particulates.
Describe structures and function of the circulatory system.	E*Have students read Chapter 22, pp.425-433. Outline the importance of fighting disease, clotting, and transportation of gases and nutrients by circulatory system.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Have class do a microscopic study to observe red blood cells in humans. Students are to use only blood lancets. THESE ARE TO BE ORDERED FROM THE SCHOOL CATALOG, Item #81.6585, Box of 250. You may prefer to have students bring permission slips to do this activity. A STUDENT IS NOT REQUIRED TO DO THIS ACTIVITY. Invite a medical technologist to demonstrate "finger stick" and make slides for the class. Investigate: How can you observe blood cells? p.431. <u>NOTE:</u> Do not use a needle. Use the sterile blood lancets. @Students may do research on the different types of white blood cells. Develop the terms: <u>coronary thrombosis</u>, <u>cerebral hemorrhage</u>, <u>stroke</u>, and <u>anti-coagulant</u> in relation to blood clotting. Teaching Strategy for pp.430-432, Observe blood clots, T115.
Identify the blood types.	Use the chalkboard and list the four blood types. If students know their blood type, write their name by that type. Use Teacher's aide on p.T114. Let the students decide who would be donors and recipients. Remind students that crossmatching is complicated and involves more than just knowing the blood type. Tell about Rh factor and the story of the Rhesus monkeys. Mention the importance of having personal identification on your person with blood type, factor, reaction to drugs, etc. Perform the experiment on blood typing.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Recognize how the lymphatic system aids the body.	Find Out More: reference work on lymphatic system, p.432. Have an activity to learn about "blisters," what causes them, what happens when a blister "appears," what is the first aid treatment of a blister, etc. @This would be a good time to have students do research on tonsils and adenoids. What are they? Is it necessary to "take them out"? Discuss infection. How does the lymphatic system help fight infection?
Describe health problems and explain ways to avoid damage of the circulatory system.	Have students make charts listing good daily habits in relationship to maintaining good health. The chart could include all members of their family and they should try to list ways to overcome bad habits and "stick" to the good ones. This should include diet, rest, exercise, smoking and coffee drinking. VALUABLE INFORMATION ON CIRCULATORY DISEASE IS AVAILABLE FROM THE AMERICAN HEART ASSOCIATION. Students usually are curious about heart attack. They are exposed to many medical TV shows, but few actually give concrete information on this subject. Incorporate the necessary First Aid for heart attack victims into their study of this body system. Invite a member of the Houston Fire Department to demonstrate the equipment used for heart attack victims. @Students could do library work on diseases related to the circulatory system. See Appendix for suggestions and Teaching Strategy for pp.429-432, T115.

THE HUMAN RESPIRATORY SYSTEM

PURPOSE:

To learn the parts and functions of the respiratory system

MATERIALS:

Torso, charts, bell jar, one-hole stopper, Y-tube, two small balloons, string, small-mouth gallon bottle, graduated cylinder, bent glass tubing, new two-hole rubber stopper, alcohol swabs, tape measure, and (if available) stop watch

EXPLANATION:

The basic function of the respiratory system is the exchange of oxygen and carbon dioxide in the lungs, the ultimate function being to supply the cell with oxygen for its life activities. The respiratory system carries out this function by the coordination of many parts.

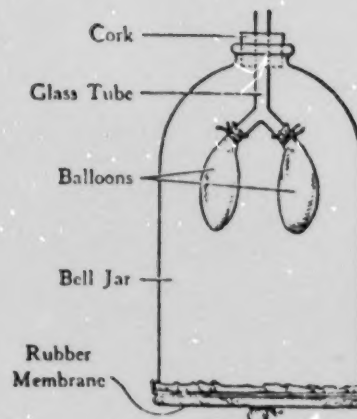
Air passes through the nostrils of the nose into the trachea or windpipe. The trachea is a tube composed primarily of cartilage, the top of which is easily felt as the Adam's apple. It divides into two smaller tubes called bronchi. The bronchi in turn divide into many smaller tubes called bronchial tubes, which divide somewhat like small branches of a tree. The bronchial tubes are lined with ciliated cells, the cilia of which are constantly lashing toward the trachea. The cilia, with the aid of coughing, prevent foreign materials from entering the lungs. The bronchial tubes end in very small, elastic air sacs called alveoli. The walls of the alveoli are very thin and lined with a rich supply of capillaries. It is through the walls of these capillaries that the exchange of oxygen and carbon dioxide occurs.

The process of respiration is broken down into three basic steps: (1) inspiration, the taking in of air; (2) oxidation, the burning of foods; (3) expiration, the exhaling of carbon dioxide and water. Two of these processes can be easily observed.

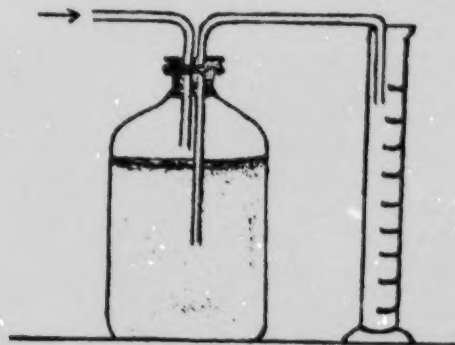
PROCEDURE I: The Mechanics of Breathing

1. Breathe deeply several times. As you do so, try to distinguish between inspiration and expiration as to the action of the ribs, diaphragm, and lungs.

2. Set up apparatus as shown in the diagram. Pull down the rubber sheet at the bottom of the bell jar. Note what happens to the balloons. Allow the rubber sheet to return to its former position and note what happens. Pull it down and relax it several times and note the effect on the balloons. Complete the drawings in Item 1, Observations and Conclusions.



3. Set up an apparatus as illustrated below. Fill a gallon bottle about 4/5-full of water. Insert the tubing into a new stopper and insert the stopper tightly into the mouth of the jar.
4. Take a normal breath and exhale into the mouth of the tubing. Use a graduated cylinder to measure the volume of displaced water. The amount of water displaced into the cylinder will be equal to the volume of the air exhaled. Roughly, this would be the capacity of the lungs. Be sure to clean the tube after use with an alcohol swab. Answer Item 2, Observations and Conclusions.



5. Work in pairs. Have your partner stand facing sideways to you, and observe the diameter of his chest as he takes a deep breath.
6. Have your partner stand with his back toward you and observe the horizontal diameter of his rib cage as he takes a deep breath.
7. Measure your chest circumference at the level of the arm pits at the end of a normal expiration. Record the number of inches. Take the same measurement at the end of a normal inspiration, and record. Take the same measurement at the end of the deepest possible inspiration. Record your measurements in Item 3, Observations and Conclusions.

PROCEDURE II: The Effect of Exercise on the Rate of Breathing

1. Work in pairs. Have your partner sit quietly with his eyes closed and breathe normally. Count and record the number of breaths per minute for 2 minutes. (One inhalation and one exhalation is a breath.) Record the average number per minute in Item 4, Observations and Conclusions.
2. Have your partner walk around the room several times, then immediately afterward count the number of breaths per minute. Record the average number.
3. Have your partner do a number of deep-knee bends, then immediately afterward count the number of breaths per minute, and record the average number.
4. Repeat the procedures for Steps 1 through 3, but count the pulse rate instead of the number of breaths per minute. Record your data in Item 4, Observations and Conclusions.

PROCEDURE III: Anatomy of the Respiratory System

1. Study the torso, charts, and references to learn the parts of the respiratory system.
2. After learning the parts of the respiratory system, label the diagram in Item 5, Observations and Conclusions.

WORKSHEET

THE HUMAN RESPIRATORY SYSTEM

OBSERVATIONS AND CONCLUSIONS:

1. Complete Diagram A to show what happens during inspiration.
Complete Diagram B to show what happens during expiration.

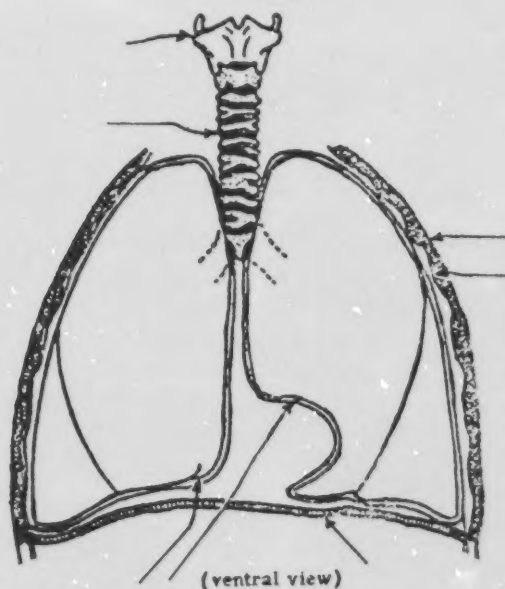


2. What is the capacity of your lungs?
3. Record of chest size:
 - a. At the end of a normal expiration
 - b. At the end of a normal inspiration
 - c. At the end of the deepest possible inspiration

4. Record of respiration and pulse rate:

	While at Rest	After Walking	After Knee Bends
Average breaths per minute			
Average pulse per minute			

5. Label the following drawing:

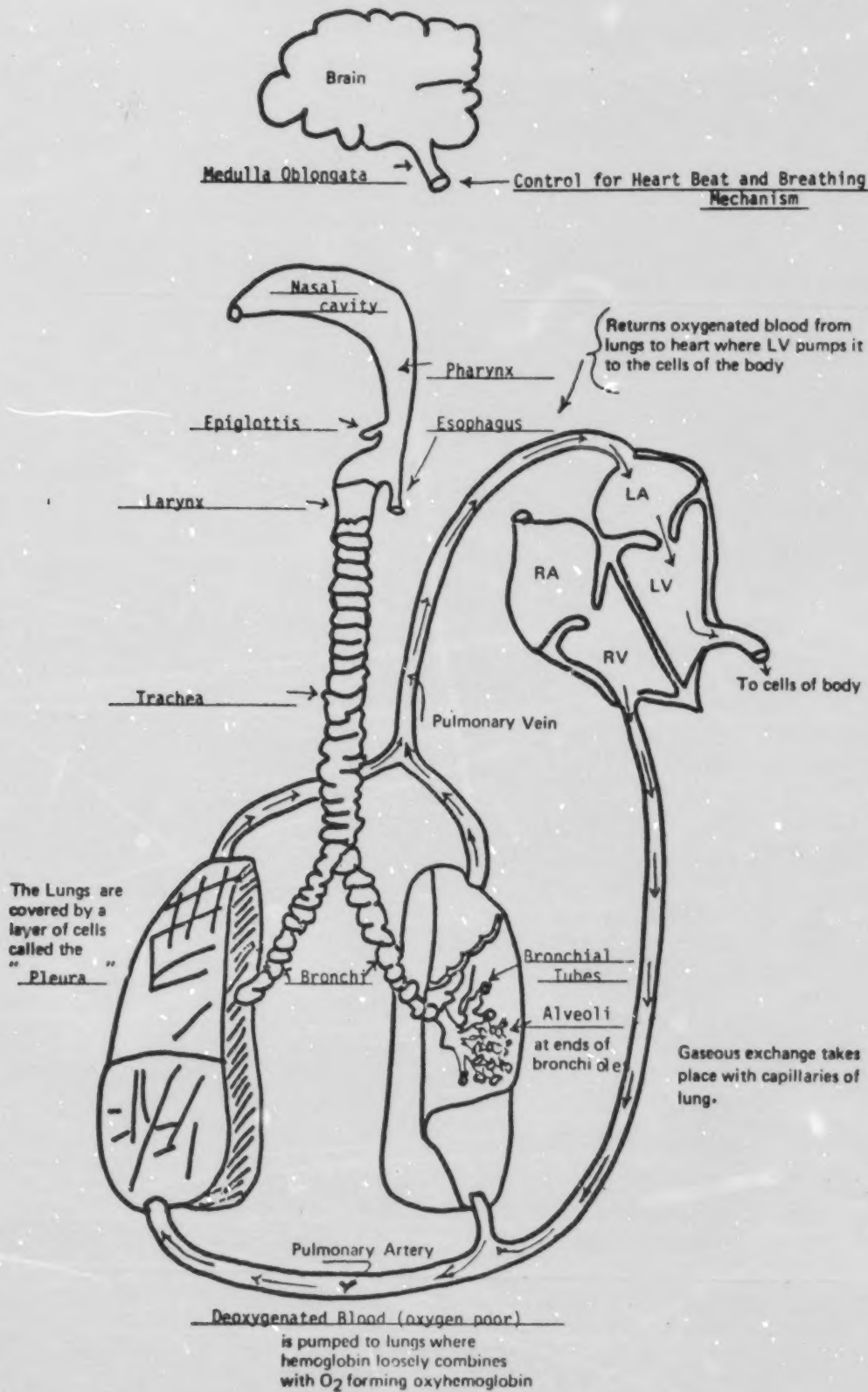


Respiratory System

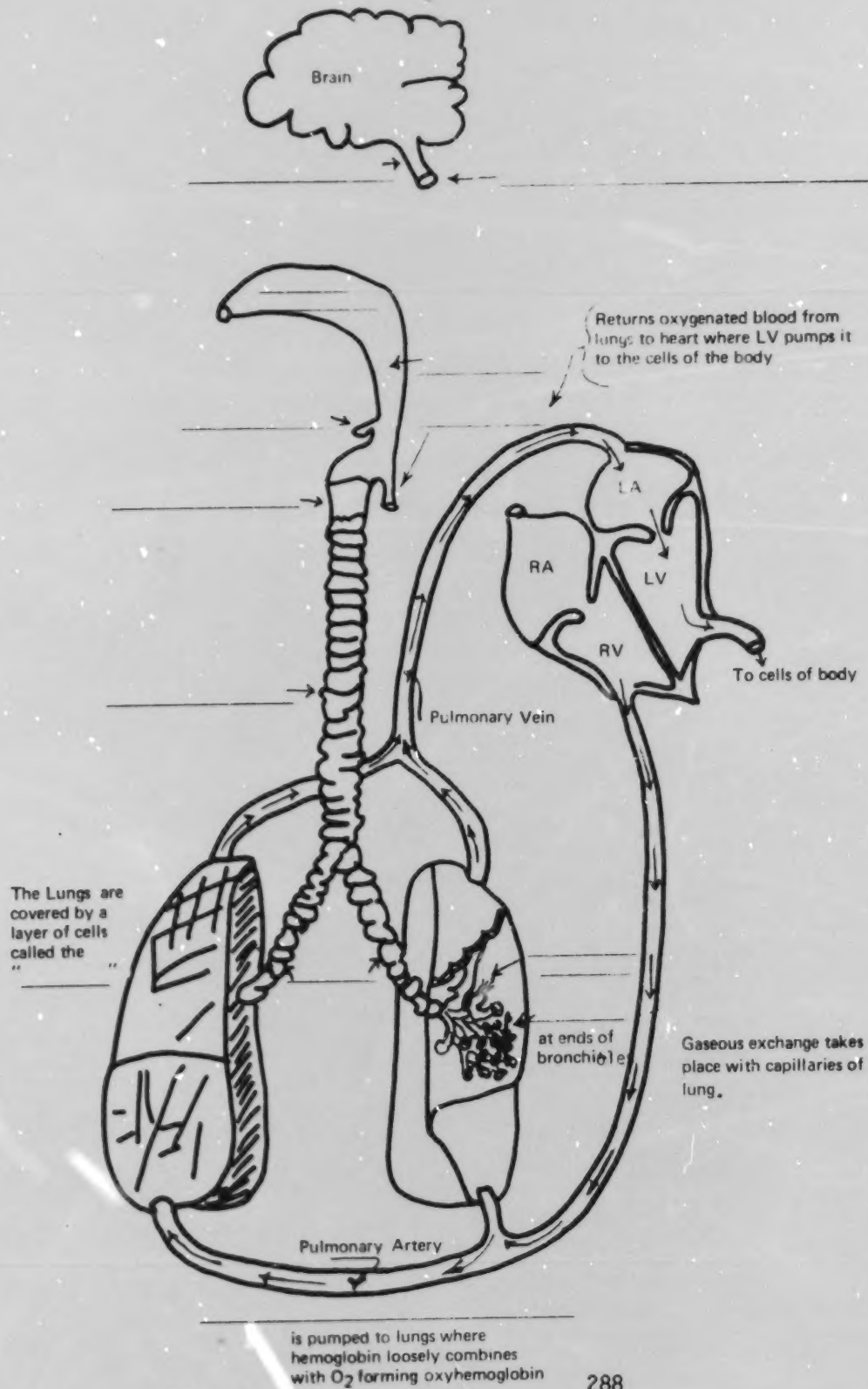
QUESTIONS FOR RESEARCH:

1. Why does activity increase the rate of breathing and of the pulse?
2. What are some of the common respiratory diseases?
3. What steps can be taken to avoid many of the respiratory diseases?

THE RESPIRATORY SYSTEM



THE RESPIRATORY SYSTEM



THE HUMAN CIRCULATORY SYSTEM

PURPOSE:

To identify the structure of the circulatory system and to learn about their functions

MATERIALS:

Nystrom Chart No. 3, heart of the human torso, references, prepared slides of cross sections of veins and arteries, microscope

EXPLANATION:

The primary function of the human circulatory system is to distribute oxygen and digested food to every cell in the body and to carry away the carbon dioxide and other wastes of the cells. The circulatory system is composed of the heart, the blood, and the blood vessels.

The heart in humans is a muscular organ this is divided into four chambers to which are connected numerous veins and arteries. The superior vena cava and the inferior vena cava are large veins which carry blood from all parts of the body into the right atrium of the heart. The right atrium receives the blood from the venae cavae and pumps it through the tricuspid valve into the right ventricle. The right ventricle pumps blood to the lungs through the pulmonary arteries. The blood exchanges its carbon dioxide for oxygen in the capillaries of the lungs and returns to the heart by way of the pulmonary veins. The left atrium receives the oxygenated blood from the pulmonary veins and pumps it through the bicuspid valve into the left ventricle. The left ventricle pumps blood out the aorta to all cells of the body through a network of 60 to 75 thousand miles of blood vessels. After the exchange of food, oxygen, carbon dioxide, and wastes, the blood flows into the veins and back to the heart.

The blood vessels--namely arteries, capillaries, and veins--are well adapted for their function of carrying food, oxygen, and wastes within the body. The arteries are thick-walled vessels which carry blood, usually bright red, away from the heart to the capillaries. The capillaries are thin-walled vessels which allow osmosis to occur readily between them and the cells. Veins are rather thick-walled vessels which carry dark red blood from the capillaries to the heart.

The blood, which is composed of plasma and corpuscles, is of the greatest importance to the circulatory system, but it will be discussed in another experiment.

Although the information in this explanation is greatly condensed, your understanding of it will be increased by the procedures that follow.

PROCEDURE I: The Structure of the Heart

Examine the heart of the human torso and identify the following structures: superior vena cava, inferior vena cava, right atrium, right ventricle, bicuspid valve, pulmonary arteries, pulmonary veins, aorta, left ventricle, tricuspid valve, and left atrium. Make the drawing indicated in Item 1, Observations and Conclusions.

PROCEDURE II: Cellular Structure of Circulatory Organs

1. Examine prepared slides of sections of veins, arteries, and capillaries. Note the differences in thickness of the walls of each. Make the drawings indicated in Item 2, Observations and Conclusions.
2. Examine a prepared slide of cardiac tissue under high power. Make the drawing indicated in Item 3, Observations and Conclusions.

PROCEDURE III:

Using the information provided in the explanation and in charts and references, trace the flow of blood from the right atrium through some organ of the body and back to the right atrium.

THE HUMAN CIRCULATORY SYSTEM

OBSERVATIONS AND CONCLUSIONS:

1. Draw a human heart and label the structures identified in Procedure I.
2. Draw the cross section of each of the following and attempt to show the relative thickness of their walls.

a. Artery

b. Capillary

3. Make a drawing of cardiac muscle tissue.
4. Using the names of the various structures of the circulatory system, complete the following scheme to show how the blood will reach the right atrium again: right atrium-bicuspid valve-

QUESTIONS FOR RESEARCH:

1. Are the muscle tissues of the circulatory system under the control of the conscious mind? Why not?
2. Why do capillaries have such thin walls?
3. What controls the valves of the heart?
4. Why is the circulatory system called "the transportation system of the body?"
5. What are some of the common diseases of circulatory organs?
6. What are some of the safeguards that may help to prevent the diseases listed above?

COMPOSITION OF BLOOD

EXPLANATION:

The chemical composition of the blood is very complex and varies in different parts of the body.

The fluid part of the blood is plasma, which consists of:

1. About 90% water, which gives blood a liquid medium for transportation of food, oxygen, and wastes
2. Protein (the remainder) which give blood a sticky quality
 - a. Fibrinogen, which is essential to blood clotting
 - b. Serum albumin, which is necessary to blood and tissue relationships during absorption
 - c. Serum globulin, which gives rise to antibodies during disease
3. Prothrombin, which is essential to blood clotting
4. Digested foods, which provide energy and materials for metabolism
5. Inorganic minerals, which are essential to normal functioning of the body
6. Nitrogen-containing wastes, which are given off by cells during metabolism



The blood also holds three kinds of cellular bodies or solid elements:

1. Red cells which combine readily with oxygen. (The red color is due to a complex iron-containing compound called hemoglobin, which is present in these cells.)
2. White cells which defend the body against infection by engulfing bacteria
3. Platelets, which are essential in the clotting of blood

EXPERIMENT

BLOOD TYPING

The four major blood types are A, B, AB, and O. Two kinds of serum are used in blood typing: Anti-A serum and Anti-B serum. The presence or absence of clumping indicates the blood types.

- I. Materials: Slide, wax marking pencil, blood sera (Anti-A, Anti-B), sterile cotton ball, alcohol, 2 glass stirring rods or 2 tooth picks rods or 2 tooth picks

II. Procedure:

1. Divide a glass slide into two equal parts using a glass marking pencil or a wax pencil.
2. Place a drop of Anti-A serum on the left side of the glass slide.
3. Place a drop of Anti-B serum on the right side of the glass slide.
4. Clean the fingertip with alcohol and allow it to air-dry.
5. With a sterile lancet, pierce the tip of your finger. Wipe away the first drop of blood with alcohol. (The teacher may choose to pierce the finger tips.)
6. Without touching the serum, drop a drop of blood to the Anti-A serum.
7. Also drop a drop of blood to the Anti-B serum.
8. The blood and serum are mixed by stirring.

CAUTION: Do not use the same stirrer for both sides of the slide!!! This could cause you to obtain incorrect results in typing your blood.

III. Results:

	Clumping	Clumping	Clumping
Anti-A serum	yes	no	A
Anti-B serum	no	yes	B
Anti-A and Anti-B sera	no	no	O
Anti-A and Anti-B sera	yes	yes	AB

IV. Did your blood form a clump with Anti-A serum? _____

Did your blood form a clump with Anti-B serum? _____

V. What is your blood type? _____

Chapter 23: Control and Regulation

Advanced Preparation: None

Major Concepts to be taught:

- The development of the central and peripheral nervous system
- The development of the brain
- The development of the nerve cell (neuron)
- The development of the sense organs
- The development of the endocrine system

Instructional Objectives:

The student should be able to -

- Describe the structure and function of the nervous system.
- Describe the difference in location and function between the central and peripheral nervous systems
- Describe the structure and function of the nerve cell (neuron).
- Distinguish between the functions of the sensory, motor, and connector neurons.
- Identify the three major regions of the brain by naming, locating and giving the functions.
- Distinguish between reflex action and habit.
- Identify the sense organs by naming, locating, and giving the functions.
- Identify major glands of the endocrine system by naming and locating.
- Associate body activities and development with hormone production by the endocrine glands.

Assessment:

The student will:

- E Identify the function of the nervous system.
- E Identify major organs of the nervous system.
- Name the two parts of the central nervous system.
- Identify the areas served by these two types of peripheral nerves: cranial nerves and spinal nerves.
- Give the name for nerve cell.
- @Label a drawing of a nerve cell with axon, dendrite, cell body, nucleus.
- Compare at least one difference in function of the motor, sensory, and connector nerve cells.
- Use a model of the brain to show the cerebrum, medulla, and cerebellum.

Match the activities to one of the three regions of the brain: hearing, running, thinking, body balance, vision, heartbeat, walking, breathing.

*Give examples of human reflex acts.

*Demonstrate a newly learned habit.

@Describe the path an impulse travels in a reflex.

*Name five sense and identify at least three examples of sense organs.

*Use the five senses and record observations.

Label the iris, pupil, lens, retina, cornea and optic nerve on a drawing of an eye and arrange these parts in the order in which light passes through the eye to the optic nerve.

Explain in his own words how the eye functions.

Label the ear drum, middle ear, cochlea and auditory nerve on a drawing of an ear.

Explain in his own words how an ear functions.

Use a torso model to locate the pituitary, thyroid, pancreas and adrenal glands.

Name the chemical secretion (term) of the endocrine gland.

@Name the gland or hormone that controls these functions:

- a) increases heartbeat
- b) regulates metabolism
- c) controls use of sugar
- d) regulates all other endocrine glands

Predict what would happen if parts of the nervous system or endocrine system malfunctioned.

E*List ways a person can help keep the nervous system healthy or unhealthy.

Materials:

Textbook: Exploring Living Things, pp.436-455.

References: Teacher's Overview, pp. T115-120.

Laboratory Experiments:

Do It Yourself: Control your muscles, p.436

Do It Yourself: Find your blind spot, p.445.

Do It Yourself: Identify taste without smell, p.448.

Investigate: How are the sense cells spaced on the back of your hand? p.449.

Activity No. 30: A Small Mammal Maze, pp.91-92. (This activity may also be used in Chapter 19.)

Activity No. 35: Reflex Action in People, pp.107-110

Activity No. 36: The Sense of Taste, pp.111-112

Activity No. 37: The Sense of Touch, pp.113-114

Films:

- L1937 - Gateways to The Mind I, 30 minutes
- L1938 - Gateways to the Mind II, 30 minutes
- 4450 - Eyes and Vision, 10 minutes
- M5854 - Drugs and the Nervous Center, 18 minutes
- M7895 - Science: New Frontiers, Exploring the Human Brain, 18 minutes
- 7678 - Nervous System, 8 minutes
- L7566 - I am Joe's Spine, 25 minutes
- M4665 - Senses of Man, The, 18 minutes

Suggested Activities:

- Summing Up, p.454
- Checking Up: Vocabulary, p.454
 - Knowledge and Understanding, pp.454-455
 - Concepts, p.455
 - Application and Critical Thinking, p.455
- Doing More, Questions 1 and 2, p.455
- Do It Yourself: List endocrine glands and hormones, p.452
- Investigate On Your Own, No. 1, p.478
- Find Out More, p.439
- Find Out More, p.444
- Teaching Strategy for pp.438-439, T117
- Teaching Strategy for p.440, T117
- Teaching Strategy for pp.440-441, T117
- Teaching Strategy for pp.441-442, T117
- Teaching Strategy for pp.444-445, T118
- Teaching Strategy for pp.450-451, T119
- Teaching Strategy for p.452, T119
- Explore Learning Activity, in guide
- Vision Activity, in guide

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the structure and function of the nerve cell (neuron). Dinstinguish²¹ between the functions of the sensory, motor and connector neurons. Identify the three major regions of the brain by naming, locating, and giving the functions.	Use the overhead projector here. Students could make a drawing of the neuron on p.439, figure 23-2. They should give the function of each part. Find Out More, p.439. Teaching Strategy for pp.438-439, Make neuron models, T117. Establish a make-believe situation, such as "burning a finger" or "scraping a toe" and have the students trace the paths taken by the impulse. The drawings on p.439, Figure 23-2 should help with the problem. Students should also think about the senses involved in the total reaction (pain, burning-heat, pressure, etc.) Students can observe reaction time to a stimulus by doing this activity. One classmate holds a ruler by the 12 inch mark while another places his thumb and first finger close to the bottom end of the ruler. The classmate releases the ruler while the other student catches it. They can measure the distance the ruler dropped before being caught and explain why there has to be a reaction time for any response. The students could also trace the path taken by the impulses as they did with the burned finger or hurt toe. Have students read pp.440-441 and make a chart showing the parts of the brain and their functions. Use the model of the brain or the torso model and have the students locate the parts.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Students may make a drawing like Figure 23-3 on p.440 or label a prepared drawing. Teaching Strategy for p.440, Compare brain structures, T117. Teaching Strategy for pp.440-441, Observe calf brains, T117.
Distinguish between reflex action and habit.	Activity No. 35: Reflex Actions in People, pp.107-110 (knee jerk, illustrates reflex arc) Activity Booklet. "Explore Learning" which is included in the guide is a good activity to show the difference between reflex and habit. Activity No. 30: A Small Mammal Maze, pp.91-92, Activity Booklet, can also be used here to show how habits may be formed. Students may 1) make a list of activities performed each day by habit, 2) select one habit they think they can improve, 3) outline a plan to change the habit, 4) keep a record of their progress, and 5) write their results.
Identify the sense organs by naming, locating, and giving the functions.	Use the models of the eye and ear to learn parts. Remove parts and scramble and ask students to put the "puzzle" model back correctly, naming the parts. Do It Yourself: Find your blind spot, p.445. Draw diagram of Figure 23-6, p.444, The Eye, and Figure 23-6, p.446, The Ear. Do It Yourself: Identify taste without smell, p.448.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Investigate: How are the sense cells spaced on the back of your hand? p.449. Activity No. 36: The Sense of Taste, pp.111-112, Activity Booklet. Activity No. 37: The Sense of Touch, pp.113-114, Activity Booklet. Let students try to distinguish different sounds with their eyes closed. This can be done on tape (having the eyes covered would not be significant.) Let students record their own voice and listen to it. Activity: "What Ticking? Where?" Use a watch with a loud "tick." Hold the watch over lab partner's head and ask him where it is located, to the side? in back? in front? (Student is blind-folded.) *Students may design a bulletin board display showing the various sense organs and indicate the importance of each as a means for making observations. Teaching Strategy for pp.444-445, Observe pupil reaction, T118. Find Out More, p.443. Doing More, No. 1, p.455. Doing More, No. 2, p.455. Investigate on Your Own, No. 1, p.478. @Students can explain how the camera is similar to the eye, as well as different from the eye. Vision Activity (included in guide).

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	@Students may do research on optical illusions and design their own. To test students' sensitivity to smell, open different containers in the front of the room and have the students write down the name of each smell when they first sense it. Some examples of odors to use are: oil of citronella, oil of peppermint, ammonia, and perfume. Obtain a beef tongue from the super-market and have the students examine it with a hand lens. Dim the lights and see if the students can distinguish color. Students may test their hearing by placing a cotton plug in one ear and move a ticking clock away from the other ear. Measure in cm. the distance at which the student can no longer hear the ticking. @Students may write reports on eye disorders such as glaucoma, color blindness, detached retina, cataracts, trachoma, and conjunctivitis. To demonstrate binocular vision, have students hold a pencil with its point up at arm's length, close the left eye and try to touch the pencil point with the right hand. Then, try the same thing with both eyes open. The school nurse can demonstrate hearing and vision tests. A good time to encourage students to get their eyes and ears checked if they are having any difficulty seeing or hearing.
Identify major glands of the endocrine system by naming and locating.	Use the chart on p.450 to learn the names of the glands and then have the students locate the endocrine glands by referring to the activity, Do It Yourself: List endocrine glands and hormones, p.452. See Teaching Strategy for p.452, T119.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Use the torso model and have the students locate the different glands.
Associate body activities and development with hormone production by the endocrine glands.	Students are always curious about growth abnormalities or extreme differences in growth patterns. Some students might wish to go into detail on these differences. Check out Guinness Book of Records. A "Mix 'N Match" game using glands, hormones, and their functions. Students can discuss the function of adrenalin as it relates to heart attack, athletic competition and the "fight or flight" theory. @Using references, students may write reports on the work of VonMehring and Minkowski, and on what they discovered about hormones. Students may design an experiment illustrating the function of the plant hormone, gibberellic acid, on dwarf and regular pea plants. Plans can involve a control, daily measurement of the plants in cm., graphing the plants' heights vs time, and writing conclusions. Teaching Strategy for pp.450-451, Plant rooting hormones, T119. Investigate On Your Own, No. 3, p.478.

ACTIVITY

EXPLORE LEARNING

Here is a series of experiments that may serve to give insight into the mechanisms of learning, and the roles played by *habit*, *sense versus nonsense*, and *trial and error* in learning.

Habit (Experiment 1)

Here is an experiment that will dramatize the power of habit. Habits are time savers. Tasks utilizing habit require little conscious thought.

Student groupings: Individuals or preferably in pairs.

Procedure: Have students write their full name as many times as they are able to do so in a given length of time (for example, half a minute.) Then ask them to write their name with their *other* hand as many times as they can in the same time interval. Let each nonwriting partner keep track of the time for the writing partner.

Analysis: Have students record the number of times they have written the name under each circumstance. Ask what causes the difference.

Habit (Experiment 2)

Student groupings: By individuals. Teacher or particular student dictates to class.

Procedure: Pick a passage from a book to dictate to the class. If everybody has a textbook, pick a paragraph from it in order that students may follow the dictation. The students are to write the material as it is read to them. Don't worry about spelling. The experiment is not concerned with that. Keep track of the time. Read at a comfortable rate.

Do this a second time, but add one change in direction. Ask the students to write as you dictate—only this time they are not to cross any *t*'s or dot any *i*'s. Have students score how many dotted *i*'s and crossed *t*'s they have accidentally made. If you want to take the time, it might be interesting to repeat this experiment several times and record the rate of relearning. That is, how many dotted *i*'s and crossed *t*'s appear in successive trials. Have each student keep track of his own results.

Make a graph on the blackboard which shows the class results. Here you would graph the number of students versus the number of dotted *i*'s. On the same graph, you might graph the number of students versus the number of crossed *t*'s. You would now have two curves plotted on the same graph.

You might prefer to gather the data on two separate graphs, one for recording dotted *i*'s and the other recording crossed *t*'s. Of course, this would mainly be of interest if you repeat the experiment several times. Each curve would then show the successive results. This would be a graphic way to record the progress of learning when the learning involves undoing habit.

Sense versus Nonsense

Student groupings: The class together.

Procedure: Choose a well-known saying. For example, you might pick "A stitch in time saves nine." You might ask students to suggest well-known sayings by handing them to you on folded

sheets of paper. Write the saying on the board in two columns. Column A shows the words jumbled. Column B shows the words in order. (Try to figure out a way to keep what you have written hidden so everyone sees it for the first time at the same time. An overhead projector works very well here.) The columns might look like this.

Column A

in
saves
nine
time
stitch
a

Column B

a
stitch
in
time
saves
nine

Now uncover Column A. Ask the students to memorize the words in order. Have them raise their hands when they have memorized the words. Have two students keep score on the board. The data you record is the time that has elapsed and the name of the student. Allow this to go on for about five minutes. How many students feel they have achieved the task? How many students feel they have memorized the nonsense list of words?

Uncover Column B. (This is the column that makes sense.) Ask the students to memorize these words in order. Record how many students have memorized this list in twenty seconds, thirty seconds, etc.

Analysis: Why was Column B so much easier to memorize than Column A? What does this tell students about learning in general?

Trial and Error

Trial and error is one of the most time-consuming ways to learn.

Materials: Four pieces of paper or card, each of the following shape; each student has his own four pieces.

This is the piece to be cut out.



You can do this experiment only if you can make a fast ditto of this shape to bring into the class or if you can cut four to eight of these shapes out of card and pass these around for the students to use as a template.

Each student should make four copies of this shape. They must be exactly the same.

If scissors are available, they can be cut out easily. However, if scissors are not available, secondary students should be able to tear them successfully by folding back and forth along the edge to be cut. This will be fairly easy if you take advantage of the corner right angles of

an ordinary sheet of paper. Because the figure has two right angles, each of the four pieces to be cut may best be laid out at the corners of a sheet of paper. In this way, it will be necessary only to cut or tear two edges for each figure rather than four.

*This is called a Dissection Puzzle.
Here is the solution to this one.*



Procedure and Analysis: At a given signal, the students are to put their four pieces together to form a perfect square. Each student may raise his hand when he has successfully completed his puzzle. (One student might keep a written record on the board of names and times of completion of the different students.)

Have the successful students put their pieces away for five minutes and then try to do the puzzle again. How long does it take them to put it together the second time?

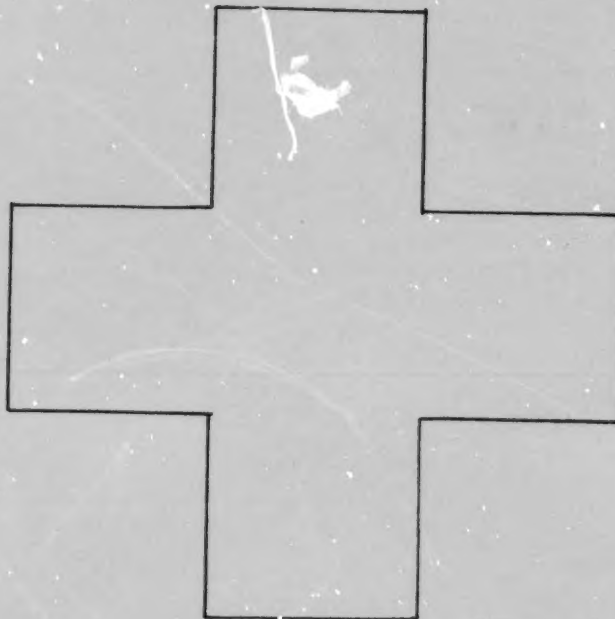
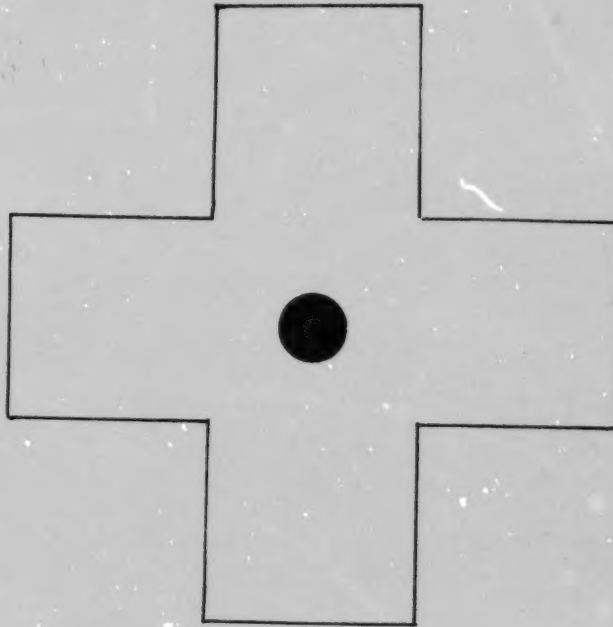
Are there some students who were successful once and can't repeat their success? What does this mean? (Hit-and-miss learning is unreliable.)

If a student in the class has been very successful with the puzzle, see whether he can explain his system to the class in great detail. (He probably had some plan in mind if he was repeatedly successful. Did he try to make two symmetric halves and then combine them? Did he realize he must put a right angle in the corner because the corner angles of a square are right angles? Did he locate the right angles in the puzzle pieces?)

After the student has shared his method with the class, you might have the class again try to put their puzzle together, all starting at the same time. Record the results this time. How do they compare with previous results?

VISION ACTIVITY

Stare at the top figure for 120 seconds with concentration
then stare at the bottom figure.



Describe what you see.

Do some reading research to explain what you see when you
stare at the bottom figure.

Chapter 24: Reproduction and Development

Advanced Preparation: None

Major Concepts to be taught:

Development of the reproductive system
Formation and development of embryo and fetus
Process of birth

Instructional Objectives:

The student should be able to -
Describe the structure and function of the reproductive system.
Describe the development of an embryo and fetus.
Explain the changes that occur in a baby after it is born.
Dissect a frog and recognize body system.

Assessment:

The student will:
E*Identify the function of the reproductive system.
E*Identify major organs of the reproductive system.
Match these terms with their definitions: puberty, egg, sperm, gonads, fertilization, ovaries, and testes.
Identify the structures in the female and male reproductive system.
Define pregnancy, amnion, uterus, umbilical cord and placenta.
Differentiate between embryo and fetus.
Describe how the developing embryo receives protection, oxygen, and nutrients from the mother.
Describe some changes that take place in a fetus during its seven months of development.
List changes that take place in a baby's ability to 1) get oxygen, 2) circulate blood, 3) obtain food, and 4) get rid of waste after it is born.

Materials:

Textbook: Exploring Living Things, pp.456-475

References: Teacher's Overview, pp. T121-125

Laboratory Experiments:

Do It Yourself: Observe the development of snail embryos,
p.464.

Films:

- 7683 - Reproductive System, 7 minutes
- M2826 - Human Reproduction, 21 minutes
- M7664 - Beyond the Naked Eye, 18 minutes
- L3471 - Animal Secrets: Critical Time, The, 24 minutes
- M2986 - Meiosis: Sex Cell Formation, 16 minutes
- M4443 - Chick Embryo: From Primitive Streak to Hatching,
13 minutes
- M2673 - Amphibian Embryo, 16 minutes
- M2793 - Frog: A Familiar Amphibian, 15 minutes
- M5523 - V.D.: A New Focus, 15 minutes
- M5158 - V.D.: Every 30 Seconds, 16 minutes

Suggested Activities:

Summing Up: p.474

Checking Up: Vocabulary, p.474

Knowledge and Understanding, p.475

Concepts, p.475

Application and Critical Thinking, p.475

Doing More, Questions 1 and 2, p.475

Pros and Cons, pp.476-477

Read On Your Own, p.479

Find Out More, p.458

Do It Yourself, p.467

Find Out More, p.469

Teaching Strategy for pp.457-458, T122

Teaching Strategy for pp.463-464, T123

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the structure and function of the reproductive system.	*Have students read and discuss Chapter 24, pp.457-472. E*Have students make a chart listing organs and functions of the female and male reproductive systems using pp.459-462. Find Out More, p.458. Teaching Strategy for pp.457-458, Puberty discussion, T122. Diseases of the reproductive system, including venereal disease may be researched and studied at this point.
Describe the development of an embryo and fetus.	*The students can copy the drawing from Figure 24-6, p.463, to show early mitotic division and growth of the embryo. Do It Yourself: Observe the development of snail embryos, p.464. *Students can draw and color picture similar to Figure 24-8, p.465, label these structures: <u>amnion</u>, <u>umbilical cord</u>, <u>placenta</u>, <u>embryo</u>, and write the functions of each part underneath. Have students make a chart listing changes in growth and development of the embryo and fetus for each of the nine months. Teaching Strategy for pp. 463-464, T123 Do It Yourself: Ask your mother about her pregnancy, p.467. Doing More, No. 1, p.475

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Explain the changes that occur in a baby after it is born.	Have students make a chart showing 1) before birth conditions and 2) changes that occur after birth for the following: obtaining oxygen, blood circulation, obtaining food, and excreting wastes. Find Out More, p.469. @Have a student do research and give an oral report on blue babies and how this condition is corrected. <u>Additional Activities</u> *A fun activity is a "baby bulletin board" whereby students try to identify classmates' baby pictures. *Most students have had yearly school pictures made and could bring them to school. "Put Me In Order," a game whereby someone puts another's pictures in order or sequence. Students can observe a) changes in head size, (b) facial characteristics, c) teeth, d) skin, e) any visible signs that show age change. *Students may have pictures of their pets taken over a period of many years. They could put them in sequence to view the aging process in animals. *Make a collection of pictures of old people to illustrate the effects of aging. *As students go about their daily activities away from school, they could observe the visual effect of aging on people and other animals: reflexes, walking posture, etc. This would be a good time to stress the need for special kindnesses and compassion with the aged.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	@There are interesting readings in the "National Geographic" and other magazines about the communities in Russia and South America that have so many centenarian citizens. This is an area of much research and, in some instances, disagreement.

UNIT 6

HEREDITY AND CHANGE

Time Allotment
10 days for entire unit

Chapter 26: Heredity and Change

Advanced Preparations:

1. Order algae from Oceanographic Center for Chapter 11.

Major Concepts to be taught:

Development of the mechanics of heredity
Function of sex cells in heredity
Relationship of genes, chromosomes, and changes

Instructional Objectives:

The student should be able to -

Recognize the contribution of Gregor Mendel to the study of heredity.

Recognize how these terms relate to heredity: trait, dominant, recessive, and incomplete dominance.

Explain how traits are passed on to offspring.

Explain the relationship of DNA, genes, and chromosomes to heredity.

Assessments:

The student will:

Name the man whose work laid the foundation for the study of heredity.

Identify the meaning of these words: trait, inherit, dominant, recessive, incomplete dominance, chromosomes, genes, and DNA.

*Name two traits that a person might have as a result of heredity and two traits that a person might have as a result of the environment.

Identify examples of dominant and recessive characteristics.

Explain how incomplete dominance works in heredity.

Name the particle found in the cell responsible for inherited traits.

Explain where a person inherits his total number of chromosomes.
Explain the importance of meiosis in forming sex cells containing half the number of chromosomes.
Explain the difference in formation of identical and fraternal twins.
Describe the relationship between DNA, genes, and chromosomes and state their location in the cell.
Explain what is meant by mutation.

Materials:

Textbook: Exploring Living Things, pp.500-519.
References: Teacher's Overview, T131-135

Laboratory Experiments:

Investigate: What are some traits you have inherited? p.505.
Investigate: How many different chromosome combinations are possible from cells that have three pairs of chromosomes? p.510.
Activity No. 38: Mutation in Corn Plants, pp.115-118
Activity No. 39: Human Heredity, pp.119-122

Films:

6095 - Inheriting Your Physical Traits, 11 minutes
M7291 - Human Heredity, 21 minutes
L2151 - Thread of Life, I, 30 minutes
L2152 - Thread of Life, II, 30 minutes
L6002 - Genetics and Plant Breeding, 17 minutes
M3100 - Laws of Heredity, 15 minutes
M2932 - Mechanism of Inheritance, 14 minutes
M6292 - Double Helix, The, 12 minutes

Suggested Activities:

Summing Up: p.518
Checking Up: Vocabulary, p.518
Knowledge and Understanding, 0.519
Concepts, p.519
Application and Critical Thinking, p.519
Doing More, Questions 1 and 2, p.519
Find Out More, p.502
Find Out More, p.512
Find Out More, p.515
Teaching Strategy for pp.502-504, T132-133
Teaching Strategy for p.507, T133
Teaching Strategy for pp.508-509, T134
Teaching Strategy for p.511, T134
Teaching Strategy for pp.512-513, T135
Teaching Strategy for pp.514-515, T135
Teaching Strategy for p.515, T135
Which Traits Are Most Common in Your Class? (In guide)

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Recognize the contributions of Gregor Mendel to the study of heredity.	Have students read Chapter 26, pp.500-507 and orally discuss the margin questions. *Have students copy and color the chart from Figure 26-1 on p.501 and make a list of the dominant and recessive traits for each characteristic. Teaching Strategy for pp.502-504, Bean game, T133. Find Out More, p.502.
Recognize how these terms relate to heredity: trait, dominant, recessive, incomplete dominance.	*Give students two gene traits for flower color (such as red and white, with red usually being dominant) and have them draw and color flowers that possess: 1)both recessive traits 2)both dominant traits 3)a dominant and a recessive trait 4)an incomplete dominant and a recessive trait Which Traits are Most Common in Your Class? Activity, included in guide. Investigate: What are some traits you have inherited?, p.505. Have students prepare a list of traits that they share with one or more of their parents. Doing More, No. 2., p.519. Activity No. 39: Human Heredity, pp.119-122, Activity Booklet.
Explain how traits are passed on to offspring.	Have students copy and color the diagram of meiosis on p.509. They can write a paragraph explaining the differences between the first and last steps of meiosis and the importance of this process.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Students may copy Figure 26-5 on p.507 to show how traits are passed on to the offspring from both parents. Teaching Strategy for pp.508-509, Clay models of meiosis, T134. Investigate: How many different chromosome combinations are possible from cells that have three pairs of chromosomes? p.510. Doing More, No.1, p.519. Teaching Strategy for p.511, Study twins, T134.
Explain the relationship of DNA, genes, and chromosomes to heredity.	To demonstrate the relationship of these terms, have the students place the words in order from smallest to largest: cell, chromosome, nucleus, gene, DNA @Students may do research on the DNA molecule and on the work of James D. Watson, Francis C. Crick and Rosalind Franklin. @Students may prepare a model of the structure of DNA. Teaching Strategy for pp.512-513, DNA game, T135. Teaching Strategy for pp.514-515, Reports on mutations, T135. Find Out More, p.515. Teaching Strategy for p.515, Discussion on radiation and mutations, T135.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	<u>Extra Activities</u> Activity No. 38: Mutation in Corn Plants, pp.115-118, Activity Booklet. Discuss Pros and cons, Genetic Engineering: How Can It Change the Future? pp.556-557. @Students may write reports on various topics relating to heredity: polyploidy, sickle cell anemia, albinism, animal breeding, pedigrees, hybridizing, Down syndrome, Tay-Sachs disease, birth defects, genetic counseling, genetic engineering, and sex-linked traits. A good source of materials and speakers on genetic diseases is the March of Dimes.

ACTIVITY

Which Traits Are Most Common In Your Class?

Trait	I Have	No. in Class Who Have	No. in 5 Classes Who Have	Percentage
Ear Lobes attached				
Ear lobes unattached				
Darwin's ear point				
Tongue roller				
Tongue nonroller				
Chin cleft				
Chin: no cleft				
Hairline, no widow's peak				
Hairline: widow's peak				
PTC taster				
PTC non taster				
Hair whorl clockwise				
Hairwhorl counter clockwise				
Little finger straight				
Little finger bent				
Eyelashes long				
Eyelashes short				

TRAITS



TONGUE ROLLING



COUNTERCLOCKWISE

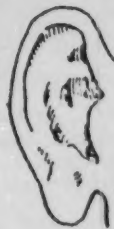


HAIR WHORL

CLOCKWISE



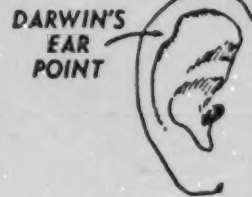
TONGUE FOLDING



FREE



ADHERENT



DARWIN'S
EAR
POINT



EXTENSION OF
END THUMB JOINT



STRAIGHT



LITTLE FINGER

BENT



Cleft Chin



WIDOW'S PEAK



LONG

EYELASHES



SHORT

Chapter 27: Changes and Development

Advanced Preparations: None

Major Concepts to be taught:

Types of changes in living things
Theories on how living things change
Ways to study changes

Instructional Objectives:

The student should be able to -
Describe ways in which living things become different.
Recognize different theories explaining how changes have come about in living things.
Identify ways to study changes in living things.

Assessment:

The student will:
*List ways in which closely related organisms differ.
State two theories of evolution.
Explain what is meant by natural selection.
Name three ways to study relationships and changes in organisms.

Materials:

Textbook: Exploring Living Things, pp.520-539
References: Teacher's Overview, pp. T136-140.

Laboratory Experiments:

Do It Yourself: Demonstrate natural selection, p.526.
Investigate: How can you tell if plants are related? p.530.
Activity No. 40: Variation Among Living Things, pp.123-126.
Activity No. 41: Protective Coloration, pp.217-130.
Activity No. 42: Natural Selection, pp.131-132.
Activity No. 43: Feet and Beaks of Birds, pp.133-136.
Activity No. 44: Comparing Homologous Parts, pp.137-140.

Films:

- M2920 - Adaptations in Animals, 16 minutes
- M2995 - Natural Selection, 16 minutes
- M6026 - Galapagos, The: Darwin's World Within Itself,
19 minutes
- L7709 - Dolphins and Men, 25 minutes

Suggested Activities:

- Summing Up, p.538
- Checking Up: Vocabulary, p.538
 - Knowledge and Understanding, p.539
 - Concepts, p.539
 - Application and Critical Thinking, p.539
- Doing More, Questions 1 and 2, p.539
- Find Out More, p.522
- Find Out More, p.524
- Find Out More, p.533
- Teaching Strategy for pp.521-522, T137
- Teaching Strategy for pp.523-528, T138
- Teaching Strategy for pp.528-529, T139
- Teaching Strategy for pp.529-531, T139
- Teaching Strategy for pp.531-533, T139
- Teaching Strategy for pp.533-535, T139
- Teaching Strategy for p.536, T139
- Helps for Careers, T140
- Heredity and Natural Selections: A Model System, in guide

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe ways in which living things become different. Recognize different theories explaining how changes have come about in living things. Identify ways to study changes in living things.	Have students read and discuss Chapter 27, pp.521-522. They can make a list showing three ways in which closely related living things may become different. Find Out More, p.523. Teaching Strategy for pp.521-522, Study differences, T137. Activity No. 40: Variation Among Living Things, pp.123-126, Activity Booklet. Have students read pages 523-528 and summarize in writing Lamarck's theory, Darwin's theory, and the special creation theory of evolution. Find Out More, p.524. Do It Yourself, p.526. Teaching Strategy for pp.523-528, Reports on theories, T138. Activity No. 41: Protective Coloration, pp.127-130, Activity Booklet. Activity No. 42: Natural Selection, pp. 131-132, Activity Booklet. Activity No. 43: Feet and Beaks of Birds, pp.133-136, Activity Booklet. Teaching Strategy for pp.528-529, Population Study, T139. @Heredity and Natural Selections: A Model System, included in guide. Teaching Strategy for pp.529-531, Make a gene pool, T139.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Teaching Strategy for pp.531-532, Barrier Study, T139. Teaching Strategy for pp.532-533, Fossil Study, T139. Teaching Strategy for p.536, Embryo comparison, T139. Investigate: How can you tell if plants are related? p.530. Find Out More, p.533. Doing More, Questions 1 and 2, p.539. Activity No. 44: Comparing Homologous Parts, pp.137-140, Activity Booklet. Helps for Careers, Visit pet shop or zoo, T140.

ACTIVITY

HEREDITY AND NATURAL SELECTIONS: A MODEL SYSTEM

Objectives

At the end of this activity the student should be able to

- . Predict the genetic makeup of a model population
- . Explain heredity and natural selection

Materials

Marbles of two different colors, at least 100 of each color, or red and white beans of the same size, or toothpicks of 2 different colors

Boxes or paper bags

How to Get Started

Let marble represent alternative forms of a gene. For example, one red could be for a taster gene (T) and blue could stand for non-taster allele (t). Each person in a population has two copies of each gene, one contributed by the mother and the other contributed by the father. Possible types (genotypes) are TT, represented by 2 red marbles, and Tt, represented by 1 red and 1 blue marble, and tt represented by 2 blue marbles. The proportion of each type will depend on the number of T compared to t in a population.

What to do in the Lab

Mix equal numbers of two colors in a box and then pick a marble without looking. Record its color and replace it. Mix marbles and draw again. Let the two marbles drawn in two successive trials represent a gene combination (genotype) of a single individual. Draw until a population of 50 or 100 individuals is created. These can be tabulated in a chart such as the following:

Both Blue	1 Blue and 1 Red	Both Red

Where to Go from Here

- . Among the individuals in your model population, how many are double blue, tt ?
- . How many are double red, TT ?
- . How many are one blue and one red, Tt ?
- . What proportion of the total population falls into each category?

Now let your model population act as the parents of the next generation. Do this by placing in a box the number of marbles that corresponds to the genotypes in your population. For example, if you had 25 TT , 50 Tt , and 25 tt , then 75 red marbles and 75 blue marbles should be put in the box. Draw marbles as before and record the types generated.

- . Do proportions of red and blue change at each generation?
- . What happens if the size of the population you generate is smaller; for example, fewer than ten individuals?
- . Repeat the drawing several times and see what happens to the red and blue during successive generations of small population. How do you account for these changes?

Other Things to Do

Start with a large population, at least 250 individuals (500 marbles), with a ratio of red to blue marbles of your choice. Now create your model population by drawing marbles as before. Reconstitute the population in the box, but this time assume that the double blues do not contribute to the next generation and reduce the number of blue marbles in the population pool by the appropriate figure. For example, if your population is 100 double red, 200 one red-one blue, and 100 double blue, the number of marbles to be placed in the box would be 300 red and 100 blue.

Create a next generation by drawing marbles as before. Reconstitute the population in the box according to the number recorded in each class, again leaving out a number of blue marbles equal to twice the double-blue category. Carry on in this fashion for several more generations, each time reducing the blues in the appropriate manner.

- . What happens when such selection is exercised?
- . Will the blue marbles ever disappear completely from the population?

Try repeating this where selection is against the one red-one blue combination as well as double blues.

- . Can you relate this selection to what actually happens in nature?
- . Can you relate this experience to the results obtained from "Protective Coloration," page 77.

Chapter 28: Searching into the Past

Advanced Preparations:

1. Collect samples of plants: lichens, algae, fungi, ferns and moss, for Unit 7.
2. Prepare bread mold for experiment in Chapter 11.

Major Concepts to be taught:

Determining the age of fossils
Development of the geologic time scale
Development of early people

Instructional Objectives:

The student should be able to -

- Explain two ways fossil age is determined.
- Describe the changing trends in types of fossil organisms found from the Archeozoic era to the Cenozoic era of the geologic time scale.
- Identify differences between early primitive people (Homo erectus), Neanderthal people (Homo sapiens), and Cro-Magnon people (Homo sapiens sapiens).

Assessment:

The student will:

- Name two radioactive isotopes used to date fossils.
- @Identify the meaning of half life and state which radioactive isotope, carbon 14 or potassium 40, has the longer half life.
- Identify dominant organisms for each era of the geologic time scale.
- Identify the early people who had the smaller brain size: Homo erectus or Homo sapiens.
- Identify the early people who: 1) first learned to make fires, 2) hunted animals for food and 3) were painters and sculptors.

Materials:

Textbook: Exploring Living Things, pp.540-555
References: Teacher's Overview, pp. T140-144

Laboratory Experiments:

Investigate: How can you make a "fossil"? p.546.

Investigate: What kind of soil might form the best fossil impressions? p.550.

Activity No. 45: Interpreting Archaeological Finds,
pp.141-144.

Films:

M7377 - Archaeological Dating: Retracing Time, 18 minutes

M2338 - Story in the Rocks, 18 minutes

6356 - Fossils: From Site to Museum, 11 minutes

Suggested Activities:

Summing Up: p.554

Checking Up: Vocabulary, p.554

Knowledge and Understanding, pp.554-555

Concepts, p.555

Application and Critical Thinking, p.555

Doing More, Questions 1 and 2, p.455

Investigate on Your Own, Questions 1, 2, and 3, p.558

Find Out More, p.542

Find Out More, p.549

Do It Yourself, p.552

Teaching Strategy for pp.541-543, T142

Teaching Strategy for pp.544-548, T142

Teaching Strategy for pp.549-552, T143

Teaching Strategy for p.552, T143

Teaching Strategy for pp.551-552, T143

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Explain two ways fossil age is determined.	Have students read Chapter 28, pp.541-543 and prepare a chart comparing these features of carbon 14 dating and potassium-argon dating: 1) half-life years 2) type of substance dated (fossil or volcanic rock) 3) procedures used to date fossil or rock Find Out More, p.542. Teaching Strategy for pp.541-543, Clarifying concept of half-life and game, T142.
Describe the changing trends in types of fossil organisms found from the Archeozoic era to the Cenozoic era of the geologic time scale.	Have students copy the chart on pp.544-545 and make drawings of the dominant forms of life found in each era. *Students may bring in fossils and determine from which era they belong. Teaching Strategy for pp.544-548, Prepare a 3D model, T142. Investigate: How can you make a fossil? p.546. Find Out More, p.549. Investigate: What kind of soil might form the best fossil impressions? p.550. Investigate On Your Own, Questions 2 and 3, p.558.
Identify differences between early primitive people (<u>Homo erectus</u>) Neanderthal people (<u>Homo sapiens</u>) and Cro-Magnon people (<u>Homo sapiens sapiens</u>)	Using pp.549-552 as a reference, have students make a chart comparing these characteristics of <u>Homo erectus</u>, <u>Homo sapiens</u>, and <u>Homo sapiens sapiens</u>: 1) age of oldest fossil found 2) brain size 3) life style

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Students may compare the photographs of skulls on p.549 and orally discuss the differences between them. Activity No. 45: Interpreting Archaeological Finds, pp.141-144, Activity Booklet. Do It Yourself, p.552. (See Teaching Strategy for p.552, T143.) @Students may do research on different anthropologists. See Careers, p.553 and Helps for Careers, T143-144. Doing More, Questions 1 and 2, p.555. Investigate On Your Own, Question 1, p.558. Teaching Strategy for pp.549-552, Construct early people, T143. Teaching Strategy for pp.551-552, cave paintings, T143.

UNIT 7

THE PLANT KINGDOM

Time Allotment
25 days for entire unit

Chapter 11: Algae, Fungi, and Lichens

Advanced Preparations:

1. Collect moss from local areas for classroom specimens. Water each day to keep fresh for use.
2. Obtain some Spanish Moss for classroom specimens. Use as a microscopic study activity.
3. Collect ferns with spores on back for experiment on p.237.

Major Concepts to be taught:

Purpose of photosynthesis

Comparison of algae and fungi and lichen according to their structure, life activities, and environmental needs

Importance of algae, fungi and lichen to man

Instructional Concepts:

The student should be able to -

Describe the process of photosynthesis and explain its significance to life on earth.

Describe and identify types of algae.

Identify the importance of algae.

Describe and identify types of fungi.

Recognize useful and harmful effects of fungi.

Describe lichens and explain their symbiotic existence.

Assessment:

The student will:

E*When given a list of substances, identify for the process of photosynthesis those which are: raw materials, source of energy, catalyst, food product and by-product

E*Explain why the successful growth of algae is essential to man.

List characteristics of algae that make them plants.

Name three groups of algae by their color.

*Use the microscope to identify diatoms and other types of algae.

List characteristics of fungi which make them plants.
 *From a collection identify the following as algae, fungi, or both algae and fungi: kelp, diatoms, seaweed, mold, yeast, lichen, mushroom, puffball, and bracket fungi. Explain how fungi obtain food since they lack chlorophyll. Describe one way in which fungi are useful. Grow mold on fruit or bread and explain which conditions are necessary for mold formation and growth. Use the microscope to identify molds. Identify what causes ringworm and athlete's foot disease. *Explain why it is dangerous to eat wild mushrooms. Name the two organisms that form lichens. Use the microscope to identify the algae and fungi in lichens. Define symbiosis.

Materials:

Textbook: Exploring Living Things, pp.212-227
 References: Teacher's Overview, pp. T59-63

Laboratory Experiments:

Do It Yourself: Observe algae, p.215
 Investigate: What kinds of molds can you find growing on bread? p.222
 Do It Yourself: Observe lichens, p.224
 Activity No. 18: Chlorophyll and Photosynthesis, pp.57-58, Activity Booklet
 Activity No. 19: Growth of Algae, pp.59-60, Activity Booklet
 Activity No. 20: Lichens, pp.61-62, Activity Booklet
 Photosynthesis I, Activity included in guide.
 Photosynthesis II, Activity included in guide.
 Extraction of Chlorophyll, Activity included in guide.

Films:

M3296 - Algae, 16 minutes
 M2469 - Fungi, 16 minutes
 M7146 - Seaweeds, 22 minutes
 M2659 - Photosynthesis and Respiration, 14 minutes
 M2980 - Plankton and the Open Sea, 19 minutes
 M7534 - Plankton, 12 minutes

Suggested Activities:

Summing Up, p.226
 Checking Up: Vocabulary, p.226
 Knowledge and Understanding, p.227
 Concepts, p.227
 Application and Critical Thinking, p.227
 Doing More, Questions 1 and 2, p.227
 Find Out More, p.217

Find Out More, p.218

Teaching Strategy for p.213, T60

Teaching Strategy for p.215, T60

Teaching Strategy for p.217, T60

Teaching Strategy for p.219, T62

Teaching Strategy for p.220, T62

Teaching Strategy for p.220, T62

Teaching Strategy for p.223, T62

Photosynthesis: The Chemical Equation and Its Breakdown,

Activity included in guide. Teacher information sheet only.

Microscopic Plants Chart, in guide

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe the process of photosynthesis and explain its significance to life on earth.	(E) Thoroughly explain the photosynthesis equation on p.213 in the margin of the Teacher's Edition. It may be easier to start with the idea that four "ingredients" are necessary for photosynthesis to take place: sunlight, chlorophyll, carbon dioxide and water. With these the plant can make its own food (glucose) and oxygen is given off as a waste product. "Photosynthesis: The Chemical Equation and Its Breakdown," a worksheet included in the guide, may be helpful in explaining this process. (E) Have the students write down some of the foods they have consumed that day and trace the foods' origins to green plants. Activity No. 18: Chlorophyll and Photosynthesis, pp.57-58, Activity Booklet. Photosynthesis I Experiment, included in guide. Photosynthesis II Experiment, included in guide. To test the effect of sunlight and photosynthesis have students place a geranium plant in darkness for two days and set one in the sunlight for two days. Remove leaves from both plants, boil in alcohol (use a water bath) to remove chlorophyll and test with iodine for starch. Record observations and conclusions. To test the effect of colored light on photosynthesis, have students cover the leaves of a geranium plant with different colored cellophane. Expose to light for a few days and then test for starch using iodine.

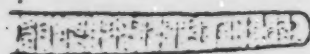
PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	*Students may make a model or mobile showing the equation for photosynthesis. @Students may set up experiments varying one of the five factors that affect the rate of photosynthesis and write a report on the results.
Describe and identify types of algae.	Have students read Chapter 11, pp.212-217. List the kinds of algae, where found, and their structures. Do It Yourself: Observe algae, p.215. Film: M3296 - Algae. Obtain some diatomaceous earth used for pool filters and observe a small amount under the microscope. Have students draw what they see. Refer to Teaching Strategy for p.217, T60. Have a microscopic lab using the fresh living algae from the oceanography center. Distribute copies of Microscopic Plants Chart, included in guide, to aid students in identification. *Have the students go on a "hunting" trip at home and in the neighborhood to find different environments for algae; for example, a dog's outside water bowl, trees, around base of the house, etc. They should be very specific and could bring back samples. Students may prepare a bulletin board display of the four groups of algae. (Refer to p.80 in text.) @Students may research some articles on algae found at the earth's poles and in hot springs. Activity No. 19: Growth of Algae, pp.59-60, Activity Booklet.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will - Identify the importance of algae.	Have students write a paragraph predicting what could happen if most of the algae on earth were destroyed by chemical pollution. Have students do some research at the library and in encyclopedias for different uses of algae. Use p.213 as a start. *Have students bring in algae food from health food stores or Oriental food shops. See Teaching Strategy for p.213, T60. Find Out More, p.217.
Describe and identify types of fungi.	Investigate: What kinds of molds can you find growing on bread? p.222. Find Out More: o.218. Students may read and outline the groups of fungi on pp.220-221; sac, club, and imperfect fungi. Film: M2469 - Fungi *Have students collect from nearby wooded areas different types of fungi. They should be interested in seeing the different types, their shapes, and color. This would be a good time to study about poisonous mushrooms. *Collect pictures of fungi. Remember: the "National Geographic" is a good resource magazine. Students may make a display of different types of fungi and molds. Teaching Strategy for p.220, Collect fungi, T62.

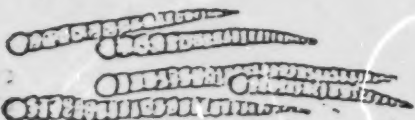
PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	*Teaching Strategy for p.220, Make mushroom spore prints, T62. Clear acrylic spray may help preserve the spore pattern. Students may test mold for hardness. Place mold in a hot water bath for 20 minutes and in a freezer for several hours. Then transfer mold to a medium and place in a warm, dark spot for several days. Have students compare the length of time it takes for mold to develop on store bought bread and homemade bread. Have students check to see if bread mold spores grow on other foods. Sprinkle spores on samples of meat, fruit, vegetables, cheese, etc. Set in a warm, dark place for several days. Bring in decaying wood and have students try to stop the decay by the use of fungicides or some other chemicals or speed up the decay by additions of various amounts of water or various temperature changes. Doing More, No. 1, p.227. Teaching Strategy for p.219, Penicillin activity, T62. Have students do reports on fungi problems and diseases: athlete's foot, ringworm, wheat rust, corn smut, Dutch elm disease, mildew and Chestnut blight.
Describe lichens and explain their symbiotic existence.	Do It Yourself, Observe lichens, p.224. Teaching Strategy for p.223, reports on symbiotic relationships, T62. Activity No. 20: Lichens, pp.61-62, Activity Booklet

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	@Have students design experiments to test for conditions that are destructive to lichens: extreme heat, extreme cold, very moist or dry conditions, and effects of different chemicals (acids and bases).

ALGAE



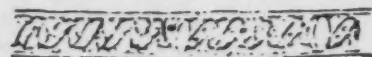
Oscillatoria



Rivularia



Spirulina



Spirogyra



Zygnema



Cladophora



Tribonema



Draparnaldia

DESMIDS



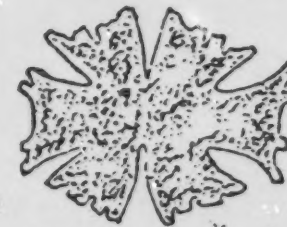
Closterium



Cosmarium



Cylindrocystis

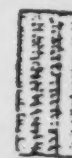


Micrasterias

DIATOMS



Meridion



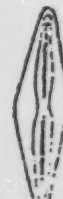
Diatoma



Fragilaria



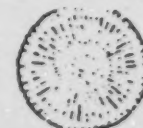
Cocconeis



Frustulia

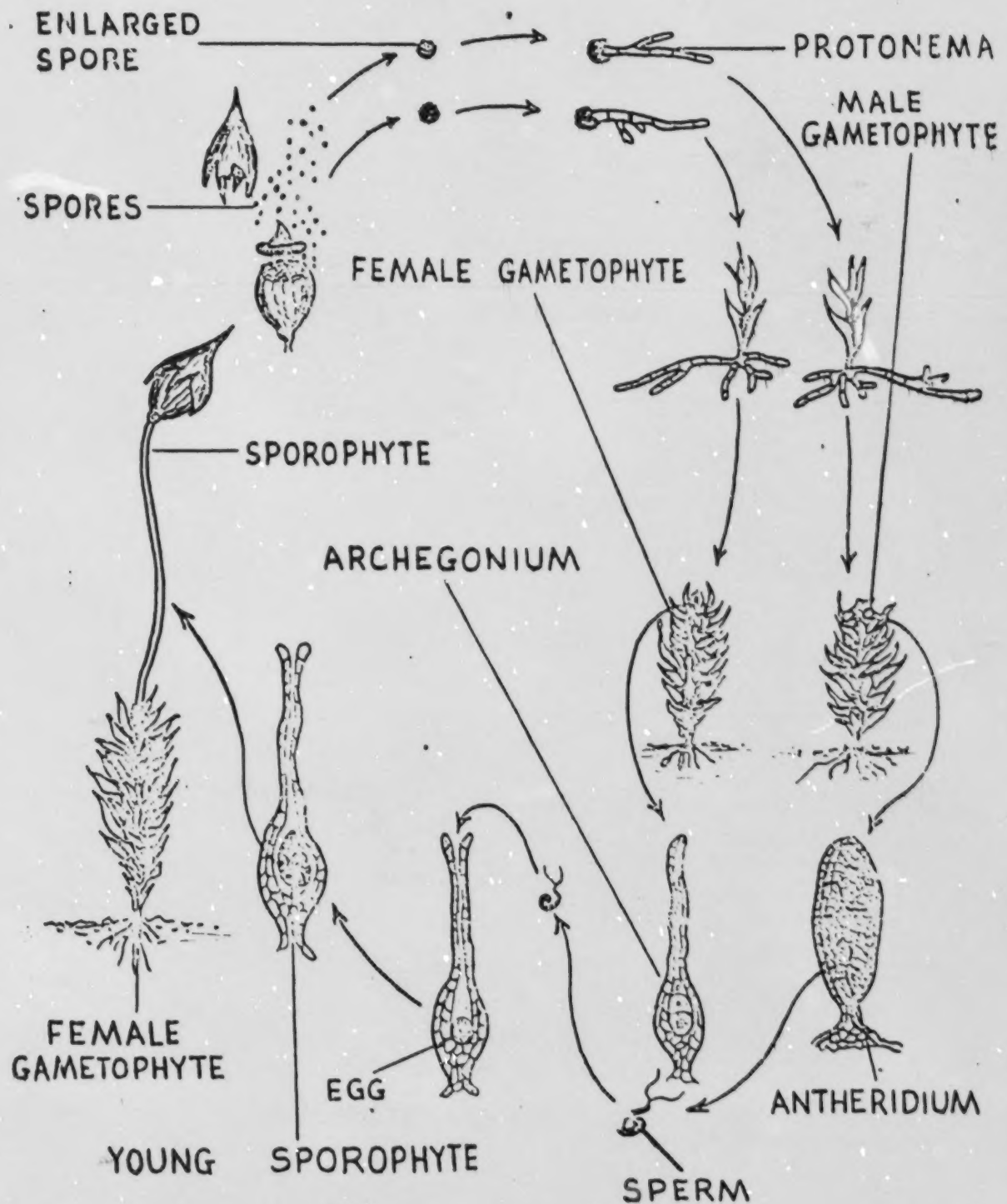


Navicula

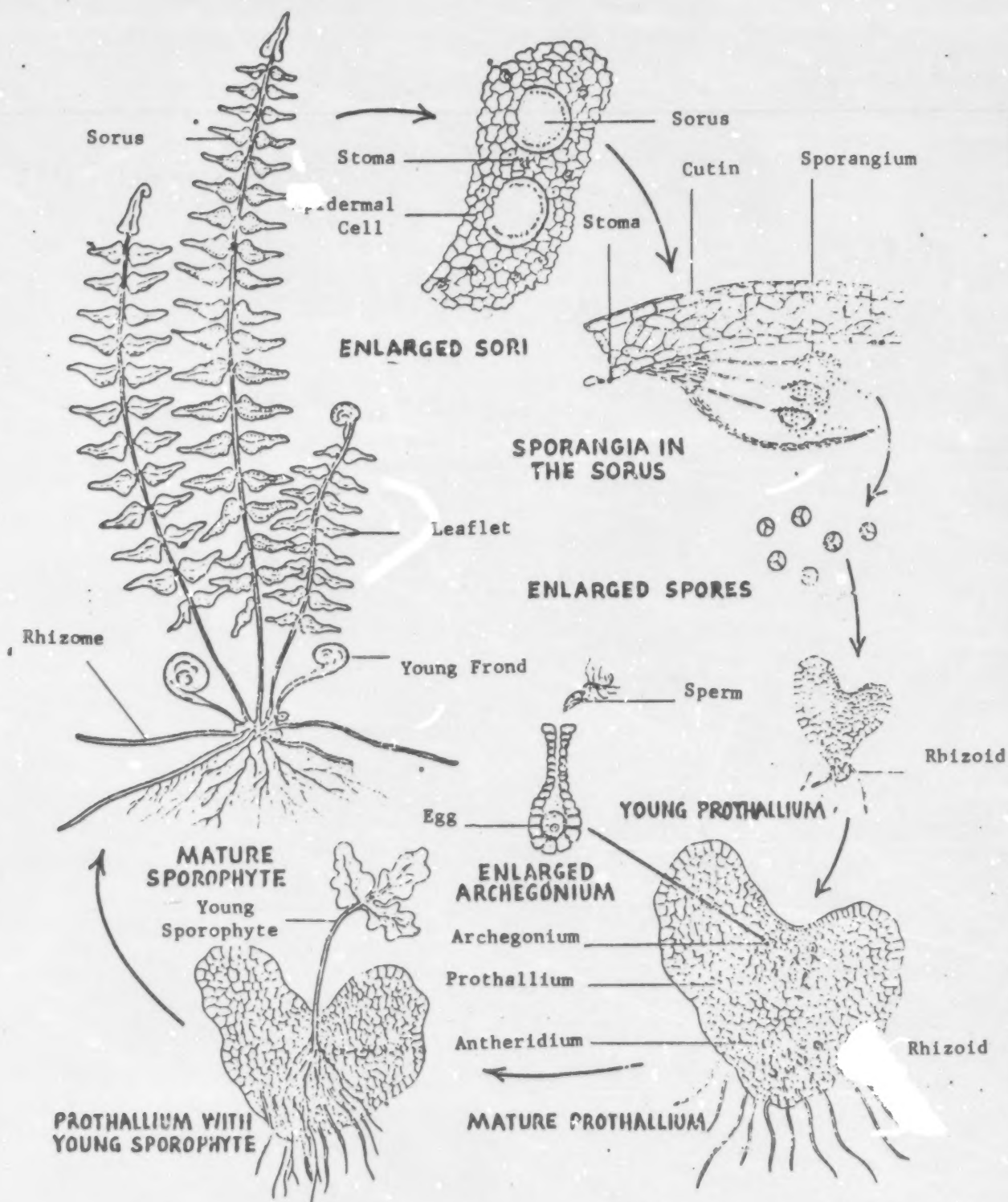


Stephanodiscus

Moss Life History



FERN-LIFE HISTORY



PHOTOSYNTHESIS I

Objectives

At the end of this activity the student should be able to

- . Determine the necessary raw materials and energy required for the manufacture of sugar and starch in plants.
- . Determine that light energy is necessary for the manufacture of sugar in plants

Materials

2 Elodea plants or sprigs
Dropper bottle of bromthymol blue
Soda straw
4 test tubes
Solid rubber stopper or cork stopper for each tube
10 cm x 20 cm piece of aluminum foil
Several 75- to 100-watt light sources
Roll of narrow freezer tape
Test tube rack or wide mouth jar to keep test tubes upright

How to Get Started

Before you begin any lab work, try to tackle these problems.

- . How does a plant differ from an animal?
- . Why is a plant green?
- . What must a plant do to grow?
- . How would you describe the environment of a plant?
- . List some ways that plants are alike and an equal number of ways they are not alike.

What to Do in the Lab

Secure four test tubes and four matching stoppers, one to fit each test tube. Also secure a test tube rack or support to keep test tubes upright.

Examine each test tube carefully to be sure it is perfectly clean. If there is evidence of any foreign matter present, wash them with a test tube brush, a cleaner, and then rinse at least three times.

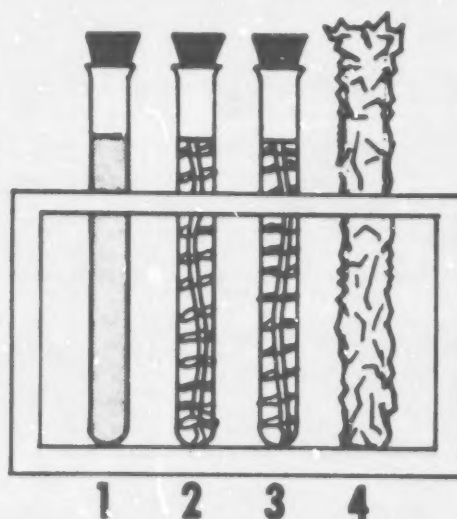
Label the outside of the tubes by taping a small square portion of masking tape on a clean dry side of each test tube. Write sufficient information to identify each tube.

Prepare bromthymol blue indicator following these steps:

- Prepare a 1.0 M solution of sodium hydroxide: To 20 g of NaOH pellets, add enough distilled water to make 500 ml of solution.
- Prepare a .01 M solution of sodium hydroxide: Dilute 5.0 ml of the 1.0 M solution of NaOH with enough distilled water to make 500 ml of solution.
- Grind 0.1 g of bromthymol blue powder with 16.0 ml of the .01 M sodium hydroxide solution. Add 234.0 ml of distilled water.

Bromthymol blue indicator changes from yellow to blue in a pH range of 6.0 to 7.6.

- 1 Blue Water**
- 2 Sprig**
- 3 Sprig**
- 4 Aluminum**



Place in a beaker 100 ml of tap water that has been stored overnight. Add to the water enough bromthymol blue indicator to change the color of the water to a very light blue. Fill the first test tube with blue water to within 2.5 cm of the top rim. Carefully blow through a soda straw that has been placed halfway down into the beaker of water making it bubble until there is a color change. Approximately one to two minutes of blowing should be sufficient. Pour the remaining water from the beaker into the other three test tubes filling each within 2.5 cm of the rim. Now place a sprig of elodea 6 cm long in test tubes 3 and 4 only. Finally, close the top of all test tubes with a stopper.

Wrap test tube number 4 with a piece of aluminum foil and place all the test tubes in a rack or support and allow them to stand near a bright light for 24 hours.

After you have completed the preparations, fill in the data table below, showing the basic information for each test tube you prepared.

No.	Contents of Tube	24-hr. Observations
1		
2		
3		
4		

Where to Go from Here

- . What plant processes are causing the color or pH changes?
- . Why did breathing in the colored water solution change the color?

- . What does the color change mean?
- . What is the relationship of the Elodea in the test tube wrapped in foil to plants growing in the dark?
- . What inference could be made about what each plant is doing to change the color of liquid?

Other Things to Do

Find out if a green plant is only green. Secure a couple of fresh leaves from any deciduous tree, such as a pecan, maple, sweet gum, sycamore. Bring them to lab, tear them into small pieces, and fit them into a clean, fireproof test tube or small beakers.

Fill an empty tin can with hot water and carefully bring it to your work area. (CAUTION: Be sure there is no open flame in your area, as you will next be working with acetone, a very volatile chemical that ignites easily.)

Fill the test tube, containing the leaves, within 4 cm of the top with acetone, a colorless chemical solvent. Set the test tube containing the leaves and acetone in the container of hot water long enough for the leaves to lose their green color and become very pale.

Meanwhile, secure a clean, empty 250 ml beaker and 2 pieces of round filter paper. Make a narrow slit in the center of one filter. Fold the second piece so that it can be inserted through the slit you have prepared and hang it downward.

Pour the green colored liquid from the test tube into the clean beaker. Allow the pieces of the leaves to remain behind in the tube. Place the round filter paper with the center slit over the beaker mouth, with the folded paper hanging down like a wick to absorb the green liquid. As the liquid spreads upward to the top filter paper, it will form a circular pattern on the upper piece of filter paper that serves as a cover over the beaker.

- . What color was each pigment that was extracted?
- . How many different pigments can you distinguish that were extracted from the leaf?
- . What is the role of pigments in a leaf?
- . Why do different pigments move at different rates up the filter paper?

PHOTOSYNTHESIS II

Objective

At the end of this activity the student should be able to determine that light energy is used by green plants.

Materials

Elodea sprig
1 beaker
Large test tube or graduated cylinder
lamp
Sodium bicarbonate
Ruler
Watch with second hand
Thermometer
pH paper (pH range 6-8)
Red, blue, and green cellophane paper

How to Get Started

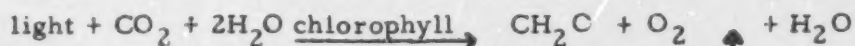
Fill beaker nearly full of water, and place lamp about 15 cm away from the beaker. Fill test tube or graduated cylinder nearly full of 0.05% sodium bicarbonate solution. A 0.05% solution of sodium bicarbonate would include .5 g of sodium bicarbonate in one liter of distilled water or tap water that has stood over night. Place sprig of Elodea in the test tube with the cut end uppermost.

What to Do in the Lab

Place the test tube in the beaker of water and turn on the light. Measure the pH of the bicarbonate solution. After a few minutes the elodea sprig should begin to photosynthesize. This can be detected by the bubbles of oxygen that emerge from the cut stem of the Elodea. If bubbles do not soon appear, cut off a bit of the stem so that a freshly cut end is exposed.

When bubbles are produced with regularity, count how many appear in a 60-second interval.

The process of photosynthesis is the use of light energy to convert carbon dioxide and water into sugar and oxygen. The general chemical equation is:



In order to be used, the light energy must first be absorbed by the chlorophyll in the leaf of the plant.

Move the lamp 7.5 cm away from the beaker and once again record the pH of the solution and the number of bubbles per minute. Take several readings to be sure a constant rate is achieved.

Move the lamp again to a distance of 30 cm from the beaker and then take another set of readings. Continue to move the lamp until further distances produce no reduction in rate. Plot number of bubbles per minute against distance from light to beaker using the graph on the next page.

Repeat the experiment with the lamp near the beaker but cover the lamp or the beaker with blue cellophane. Record the one-minute bubble counts. Repeat using red cellophane and green cellophane.

Where to Go from Here

- . How much faster or slower were the bubbles produced when the lamp was at 7.5 cm than at 15 cm?
- . What inferences can you draw about the amount of energy available to the plant when the lamp is placed at a distance of, say, 15 cm, compared to 30 cm?
- . Did the pH change as photosynthesis proceeded?
- . What could cause the pH of the solution to change? (Hint: Measure the pH of distilled water and compare it to the 0.05% sodium bicarbonate solution.)
- . Why was the plant placed in the bicarbonate solution?
- . Which wave lengths of light are the most effective for photosynthesis?

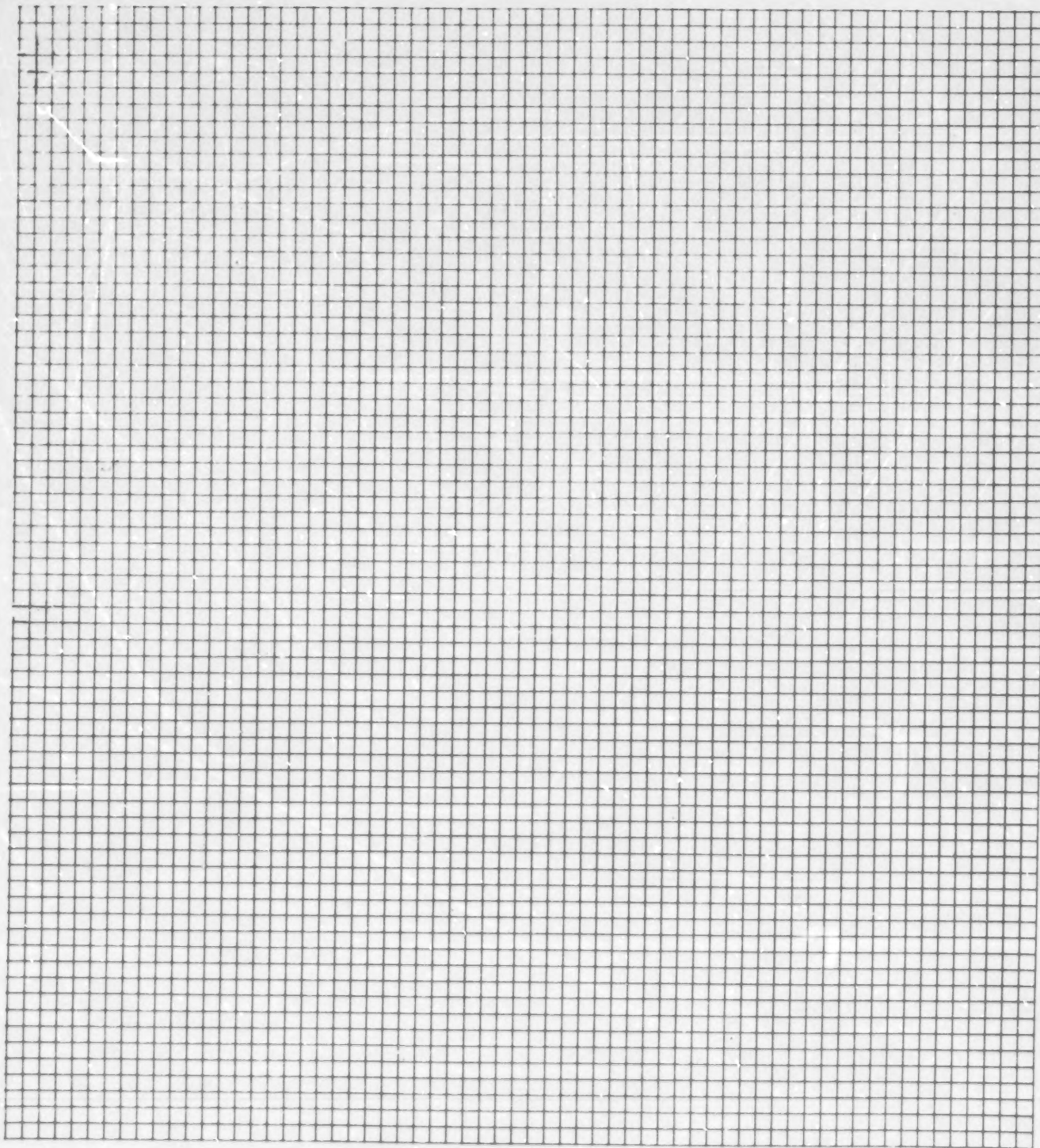
- . Does this give you a clue about why the chlorophyll in leaves is green?

Other Things to Do

Attach a manometer to the top of the test tube containing the photosynthesizing sprig of Elodea and measure the volume of O_2 evolved.

Try varying the amount of bicarbonate in the solution. Begin with distilled water which has been boiled to drive out the dissolved CO_2 . This should, of course, be allowed to cool to room temperature before putting in the Elodea.

Try varying the temperature of the solution of bicarbonate to see whether temperature influences the rate of photosynthesis.



TEACHER DEMONSTRATION

EXTRACTION OF CHLOROPHYLL

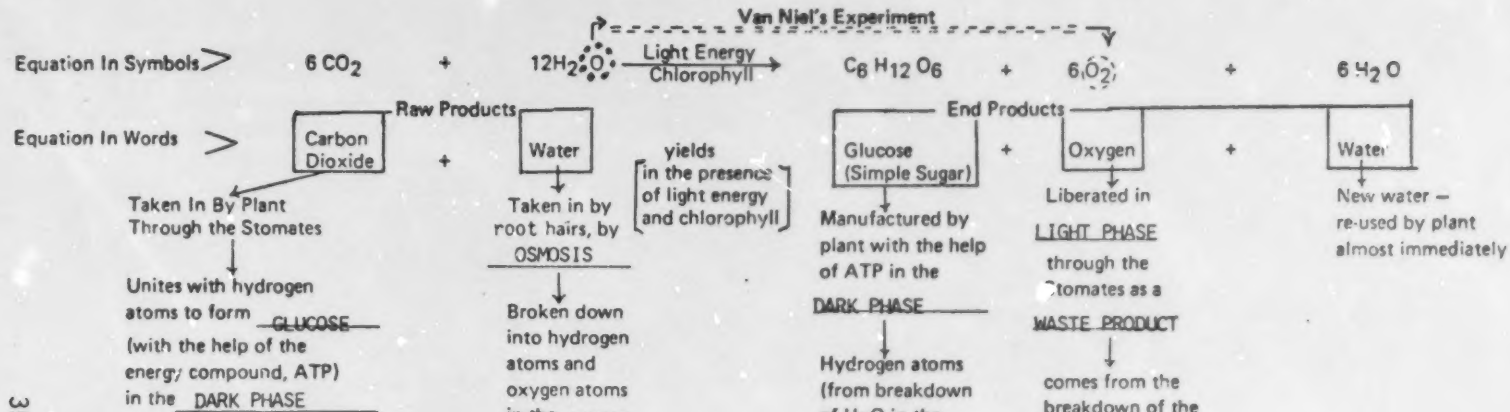
A. Quick method for extracting chlorophyll consists of:

- a) Selecting leaves of high chloroplast content (such as spinach)
- b) Cutting the leaves as small as possible with scissors or on a cutting board
- c) Grinding the pieces with fine sand using a pestle and mortar
- d) Steeping in hot alcohol (or heating over a water bath)
- e) Filtering through filter paper or cotton wadding in a funnel

NOTE: The heating of the alcohol must be done with extreme caution to prevent setting fire to the vapors. An electric hot plate is preferable to an open flame. It is also wise to have a fire extinguisher close by.

TEACHER INFORMATION SHEET

PHOTOSYNTHESIS – THE CHEMICAL EQUATION AND ITS BREAKDOWN



LIGHT PHASE (occurs first)
-ATP Formed
- H_2O Breakdown
Oxygen given off as waste



Chlorophyll – a catalyst
in chloroplasts concentrated in palisade layer
Activates Chlorophyll Electron
ATP – energy-rich compound formed by de-activation (energy release) of chlorophyll electron

Water
Breaks down into:
Oxygen – given off as waste through stomates
Hydrogen

DARK PHASE
- CO_2 taken in through stomates
Glucose formed

CO_2

Taken in through stomates

Unites chemically with hydrogen atoms split from H_2O in light phase to form **Glucose** – a simple sugar

used in metabolism, excess stored as starch.

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Chapter 12: Mosses and Ferns

Advanced Preparations: None

Major Concepts to be taught:

Structure and development of mosses
Structure and development of fern
Importance of vascular tissue in plants

Instructional Objectives:

The student should be able to -
Identify the structure of mosses and describe their importance.
Describe the life cycle of mosses.
Identify the structure of ferns.
Describe the life cycle of ferns.
Identify the function of vascular tissues in plants.

Assessment:

The student will:
Describe the type of environment mosses and ferns are found growing
List at least two uses of sphagnum, or peat moss.
Identify which plant, moss or fern, does not have true roots, stems or leaves.
Describe one difference and one similarity in the life cycles of mosses and ferns.
*Locate the sori, or spore cases, on a fern frond.
State two reasons why vascular tissue is important to plants.
Identify which plants have vascular tissue: algae, fungi, mosses, ferns, pine trees, and flowering plants.
Identify the functions of xylem and phloem.

Materials:

Textbook: Exploring Living Things, pp.228-243
References: Teacher's Overview, pp. T63-68

Laboratory Experiments:

Do It Yourself: Examine and test Sphagnum moss, p.231
Investigate: How can you estimate the number of spores found on a frond? p.237
Do It Yourself: Examine stems for vascular tissues, p.240

Films:

- M3119 - Ferns: Vascular Plants, 13 minutes
- M5043 - Mosses, Liverworts, and Ferns, 14 minutes
- M3120 - Mosses: Simple Land Plants, 13 minutes
- M2987 - Evolution of Vascular Plants: Ferns, 16 minutes
- M2988 - Origin of Land Plants: Liverworts and Mosses,
13 minutes

Suggested Activities:

Summing Up, p.242

Checking Up: Vocabulary, p.242

Knowledge and Understanding, pp.242-243

Concepts, p.243

Application and Critical Thinking, p.243

Doing More, Questions 1 and 2, p.243

Find Out More, p.231

Teaching Strategy for p.230, T64

Teaching Strategy for p.231, T65

Teaching Strategy for pp.232-233, T65

Teaching Strategy for pp.234-235, T66

Teaching Strategy for pp.236-238, T66

Teaching Strategy for p.240, T67

Moss Life History, in guide

Fern Life History, in guide

The Structure of a Moss Plant and Fern Plant Worksheet, in guide

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Identify the structure of mosses and describe their importance.	Have the students read Chapter 12 and go over questions for class discussion. *Examine live specimens of mosses and use hand lens to observe structures. Have students draw what they see. *Do It Yourself: Examine and test Sphagnum Moss, p.231. Find Out More, p.231. @Students may prepare a report on the part played by mosses in the making and conservation of soil. Teaching Strategy for p.230, Look for mosses, T64. Teaching Strategy for p.231, Use of Sphagnum moss, T65. Film: M3120 - Mosses
Describe the life cycle of mosses.	Have students copy the diagram on p.233 and identify which part demonstrates sexual reproduction and which part demonstrates asexual reproduction. Read over section "life of a Moss" pp. 232-233, Moss reproduction, T65. Students may study Moss Life History diagram, included in guide. Teaching Strategy for pp.232-233, Moss reproduction, T65.
Identify the structure of ferns.	*Students can collect varieties of ferns, bring them to class and record observations. Film: M3119 - Ferns: Vascular Plants Investigate: How can you estimate the number of spores formed on a frond? p.237.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Teaching Strategy for pp.234-235, Fern activity, T66. Doing More, No. 2, p.243.
Describe the life cycle of ferns.	Have students copy and color the diagram of the fern life cycle on p.238 and identify which part demonstrates sexual reproduction, and which part demonstrates asexual reproduction. @Students may compare the life cycles of fern and moss, listing similarities and differences. Review section "Life Cycle of Ferns" pp.236-238. Students may study Fern Life History diagram, included in guide. Doing More, No. 1, p.243. Teaching Strategy for pp.236-238, Life Cycle of Fern, T66. *Order fern prothallus from Oceanography Center and have students observe with hand lens. Students may complete the worksheet on the Structure of a Moss Plant and The Structure of a Fern Plant, included in guide.
Identify the function of vascular tissue in plants.	Have students discuss section on "Vascular Tissues," pp.238-240. Students can make a chart comparing vascular to non-vascular plants in these ways: 1) environment it can be grown 2) size 3) method of transporting water and food 4) examples Do It Yourself: Examine stems for vascular tissues, p.240. Teaching Strategy for p.240, xylem and phloem activity, T67.

The Structure of a Moss Plant

1. After studying the explanation and the drawing of the life cycle of a moss plant, examine the specimen with a hand magnifier to locate the rhizoids, stems, and leaves.
2. Examine the shape of the leaves and note the way in which they are connected to the stem.
3. Study several of the uppermost leaves and locate the archegonium and the antheridium.
4. Locate a stalklike growth on an upper leaf and examine the stalk and capsule.
5. Using your forceps, remove the capsule covering (calyptra) and examine the capsule with a hand lens.
6. Hold the top end of the capsule gently with forceps and remove the tiny disc-shaped lid of the capsule.
7. Re-examine the capsule and note the ringed, teethlike opening through which the spores escape.
8. Sift some of the spores into a drop of water. Stain your specimen with methylene blue and cover it with a cover slip.
9. Focus the spores under low power of the microscope and examine them and under high power.

The Structure of a Fern Plant

1. Examine a fern plant and locate the rhizome (underground stem) and the roots that grow from it.
2. Examine the back side of the fern frond and locate the sori (spore cases).
3. Examine a single sorus with the hand lens. A close examination will reveal a thin membrane covering many cup-shaped sporangia beneath it.
4. Scrape several sporangia into a drop of water on a microscope slide, cover it, and examine the sporangia under high power.

Chapter 13: Gymnosperms

Advanced Preparations:

1. Collect flowers for flower dissection.

Major Concepts to be taught:

Characteristics of conifers
Uses of conifers
Kinds of gymnosperms

Instructional Objectives:

The student should be able to -
Describe characteristics of conifers.
Identify areas where conifers grow.
Explain the economic importance of conifers.
Identify gymnosperms other than conifers.

Assessment:

The student will:

- *Identify three examples of conifers.
Explain the difference between the terms evergreen and deciduous and identify which term relates to most conifers.
Identify where seeds develop in most conifers.
Identify a conifer in the school or Houston area and describe its characteristics.
- *State two uses of wood
- *List six products made from wood.
Distinguish between hardwood and softwood.
- @Explain the main steps in making paper.
Name one gymnosperm other than a conifer.

Materials:

Textbook: Exploring Living Things, pp.244-263

References: Teacher's Overview, pp. T68-72

Laboratory Experiments:

- Do It Yourself: Observe conifers, p.250
- Do It Yourself: Make a display of wood and wood products, Investigate: How can you make paper? p.256

Films:

- 7123 - Up to the Sequoias, 8 minutes
- M3532 - Our Changing Way of Life: The Lumberman, 15 minutes

Suggested Activities:

- Summing Up, p.262
- Checking Up: Vocabulary, p.262
 - Knowledge and Understanding, pp.262-263
 - Concepts, p.263
 - Application and Critical Thinking, p.263
- Doing More, Questions 1 and 2, p.263
- Study of Houston Area Trees, included in guide.
- Pros and Cons, pp.284-285, T77
- Find Out More, p.246
- Find Out More, p.255
- Find Out More, p.258
- Do It Yourself, Find Out about extinct gymnosperms, p.260
- Helps for Careers, T71
- Teaching Strategy for p.245, T69
- Teaching Strategy for p.246, T69
- Teaching Strategy for pp.246-248, T69
- Teaching Strategy for p.251, T70
- Teaching Strategy for p.253, T70
- Teaching Strategy for p.254, T70
- Teaching Strategy for p.258, T71
- Teaching Strategy for p.260, T71

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Describe characteristics of conifers.	Have students read Chapter 13, pp.245-250 and outline these characteristics of most conifers: appearance of leaves, deciduous or evergreen, and method of reproduction. Do It Yourself: Observe conifer cones, p.250. Students may collect cones from various evergreen trees and make a chart showing how the seeds develop. To demonstrate the seeds of a pine cone, boil an immature pine cone in water to open the scales. Students can examine the seeds on the scales and hypothesize how they are dispersed. Teaching Strategy for p.245, tall conifers report, T69. Teaching Strategy for pp.246-243, Variety of conifer cones, T69.
Identify areas where conifers grow.	Have students draw and color or cut out pictures from magazines different types of conifers. Provide them with an outline map of the United States and have them paste the trees in the proper regions. (Refer to p.247) Find Out More, p.246. Teaching Strategy for p.246, Soil preference, T69.
Explain the economic importance of conifers.	Show film: Our Changing Way of Life: The Lumberman. Do It Yourself: Make a display of wood and wood products, p.252.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -	After reading the section on "Paper," pp.254-255, have the students outline the steps on how paper is made. *Students may collect drawings of pictures of products made from the lumber industry and make a chart. Visit a lumber yard and get samples of different kinds of wood available in our area. Find Out More, p.255. Investigate: How can you make paper? p.256. Helps for Careers, T71. Doing More, numbers 1 and 2, p.263. Teaching Strategy for p.251, other wood products display, T70. Teaching Strategy for p.253, make plywood, T70. Teaching Strategy for p.254, make paper, T70.
Identify gymnosperms other than conifers.	Discuss pp.257-260 and have students bring in leaves and cones of any of these gymnosperms (i.e. sago palms or ginko) Find Out More, p.258. Do It Yourself: Find out about extinct gymnosperms, p.260. Teaching Strategy for p.260, T71. Additional Activity: Study of Houston Area Trees, included in guide.

NAME _____

PERIOD _____ DATE _____

STUDY OF HOUSTON AREA TREES

You will study trees and their leaf characteristics native to the Houston area by making a collection and classification system. Collect, preserve, mount, label, and classify your leaves according to the directions below. Each student will turn in his project in a notebook or other appropriate display on or before _____.

Instructions for leaf collection notebook

I. Collection

Collect leaves from 15 or more different kinds of trees.
Collect no more than two leaves per tree type.

II. Preserving

Preserving the leaves may be done by several methods:

- A. Place your leaves between the pages of a telephone book. Put several heavy books on top of the telephone book for at least one week, causing them to be dried and preserved.
- B. Construct a press of cardboard. Place your leaves between layers of cardboard and newspaper. Tie your press tightly for at least one week.

III. Mounting

Each leaf(ves) for each tree must be mounted on a separate sheet of paper in your project notebook or poster display. Use any of these methods to mount your preserved leaf. You may use the front and back of your papers.

- A. Place your leaf between two cut sheets of wax paper. Iron the edges of the wax paper with a cool iron. Do not iron over the leaf. Glue or tape the specimen to the sheet of paper that will go in your project display or notebook. Label your paper as directed below in section IV.
- B. Glue your leaf directly onto the sheet of paper in your project notebook or display. Label as directed in section IV.
- C. Each leaf and its label (see directions in section IV) may be placed between two sheets of clear plastic contact paper or album sheets.

IV. Labeling

Each page with mounted, preserved leaf(ves) is to be labeled in the bottom right hand corner of the page. Print your information as follows:

COMMON NAME OF TREE _____ (if known. Number your unknowns.
Ex: unknown #1)
CLASS _____ (This is to be the class name that this leaf falls under in your classification system. See section V.)
DATE COLLECTED _____
PLACE COLLECTED _____ (Location of tree: address, subdivision, park, etc.)
COLLECTED BY _____ (person who collected the leaf).

V. Inventing your Classification System

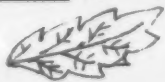
A. Group your leaves according to their physical characteristics and form your own classification system using the outline below. You must have at least two phyla and four classes.

KINGDOM (plants)					
PHYLUM			PHYLUM		
(List the leaves for each class.)	CLASS	CLASS	CLASS	CLASS	(The class name goes in the label for each leaf specimen.)
	1.	1.	1.	1.	
	2.	2.	2.	2.	
	3.	3.	3.	3.	
	4.	4.	4.	4.	

B. All of your leaves must fit under one of the classes you invented. Some suggestions to help you choose your phylum and class name titles could be by using the following characteristics of leaves.

1. Color of leaf. Ex: green, red, yellow, purple, etc.
2. Vein pattern of leaf.

palmate



or parallel

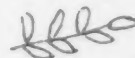


3. Number of leaves per unit:

simple



or compound



4. Size of leaf. Ex: 2 cm and under, more than 2 cm.

5. Edges of leaves.

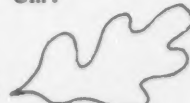
smooth



serreted



lobed



6. Use any other characteristics of leaves that help you classify them.

VI. Total notebook or display arrangement

Your notebook collection or display should be neat and presentable. It should have the following items:

- A. Title page: title, your name, class period, date project is turned in
- B. Table of Contents: include page numbers
- C. Your classification system outline. See Part V. above. Do this on a separate sheet of paper.
- D. Observations made of the trees or leaves while you made your collection
- E. Preserved, mounted, and labeled leaves. Group them according to your phylum groups. Subgroup these according to your class groups.

VII. Grade

Your grade will be determined according to the following items:

- A. Number of trees (at least 15)
- B. Accurate identification (List unknown and number them if unable to identify.)
- C. Neatness
- D. Inventiveness of your classification system
- E. Correct labeling of specimens
- F. A letter grade will be taken off your project grade each day it is late after the due date.

Chapter 14: Flowering Plants

Advanced preparations:

1. Prepare materials for additive unit. Be sure to order booklets and pamphlets in advance. See front of this guide for addresses.

Major Concepts to be taught:

Uses of flowering plants
Characteristics of flowering plants
Comparisons of monocotyledons and dicotyledons
Development of hybrid plants

Instructional Objectives:

The student should be able to -

- Identify uses of flowering plants
- Identify by naming, locating, and giving functions of the parts of the flower
- Show and describe the process of seed germination
- Distinguish between pollination and fertilization
- Describe differences and similarities in monocotyledon and dicotyledon seeds and plants
- Recognize the methods used and the importance of producing new plant varieties

Assessment:

The student will:

- ① List two uses of the product of the flower.
- ① Identify the function of the flower.
- ① Explain why the successful growth of plants is essential to man.
- *Use a flower model or drawing to identify the petals, sepals, stamens and pistil. Give the function of each of these parts.
- Name ways that seeds may be dispersed from the parent plant.
- Identify flowers as either complete or incomplete, perfect or imperfect.
- Define germination.
- *Make observations and collect and interpret data on germination of seeds.
- Define pollination and fertilization.
- *List two ways in which pollination may take place.
- Identify examples of seeds as either monocotyledon or dicotyledon.
- Identify the seed coat, cotyledon, and embryo of monocots and dicots.

- @Describe how monocots and dicots differ in their flowers, leaves, and stems.
- @Define hybrid.
- @Describe at least one method used to produce hybrid plants.

Materials:

Textbook: Exploring Living Things, pp.264-283
 References: Teacher's Overview, pp. T3-77
 Seed catalogues

Laboratory Experiments:

- Investigate: Do treated seeds begin to grow faster than untreated ones? p.267
- Do It Yourself: Compare different flowers, p.273.
- Do It Yourself: Decide which plants are dicots and which are monocots, p.279
- Activity No. 21: Effects of Temperature on Seed Germination, pp.63-64, Activity Booklet
- Activity No. 22: Parts of a Seed Necessary for Germination, pp.65-68, Activity Booklet
- Experiment: Flower Parts and Pollen Germination, included in guide.

Films:

- 1575 - Carnivorous Plants, 10 minutes
- M7540 - Carnivorous Plants, 12 minutes
- M3334 - Secrets of the Plant World, 15 minutes
- M5077 - From Blossom to Fruit, 15 minutes
- 2663 - Leaves of Green, 11 minutes
- 6395 - Wildflowers, 11 minutes
- 6788 - Poison Plants, 11 minutes

Suggested Activities:

- Developing New Varieties of Plants, p.281. (See T77 for ways to use this career feature.)
- Summing Up, p.282
- Checking Up: Vocabulary, p.282
 - Knowledge and Understanding, pp.282-283
 - Concepts, p.283
 - Application and Critical Thinking, p.283
- Doing More, Questions 1 and 2, p.283
- Investigate Your Own, Question 2, pp.286-287
- Read On Your Own: Suggested books on this unit for further information and interest for students, p.287.
- Find Out More, p.266
- Find Out More, p.270
- Find Out More, p.274
- Find Out More, p.279
- Teaching Strategy for p.266, T74
- Teaching Strategy for p.269, T74

Teaching Strategy for p.270, T74

Teaching Strategy for p.272, T75

Teaching Strategy for p.276, T76

Teaching Strategy for p.279, T76

Parts of Plants Used for Food, handout included in guide

Basic characteristics listing of over 200 garden flowers,
handout included in guide.

Parts of a Flower Information Sheet, in guide.

Parts of a Flower Worksheet, in guide.

Seeds and Seed Dispersal Information Sheet, in guide.

Seeds and Seed Dispersal Worksheet, in guide.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Identify uses of flowering plants.	Refer to "Parts of Plants Used for Food." included in guide. Have the students identify stems that may be eaten and let them sample some. (NOTE: Use a good resource.) *Have students identify leaves that may be eaten and have some samples (celery leaves, spinach, mustard greens, lettuce, etc.). *Have a root lab and let the students taste different "root food." They may enjoy tapioca and sassafras tea. (You may wish to have separate labs for stems, leaves, seeds, and flowers or combine all of these "plant foods" into one day's activity.) (E) Have students bring to school examples of seeds we eat, jewelry made from seeds, vanilla flavoring, spices, and other products made from seeds. Students can plant some of these seeds that we eat to see if they grow. Have students test different seeds for food (starch) by placing a drop of iodine on the cotyledons. @Students may write reports on the way in which coffee and chocolate are made from seeds. @Students may write reports on ways soybean protein is prepared and flavored to resemble meats. Make copies of 200 Garden Flowers (included in guide) to share with students. Find Out More, p.266. Find Out More, p.279.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	Teaching Strategy for p.266, food plants, T74. Doing More, Question 2, p.283.
Identify by naming, locating, and giving functions of the parts of the flower.	(E) Discuss with class the function of the flower on plants. Have students read Chapter 14, pp.264-283. Have students outline the parts of the flower, their location, and their functions. *Use the model of the flower and have the students identify the parts. Distribute copies of Parts of a Flower, Information Sheet, in guide. Have students complete Parts of A Flower Worksheet, in guide. *Have the students bring pictures of flowers to school. On each flower have the students find or label the petals, sepals, stamens, and pistil. Each flower could then be classified as complete or incomplete. *Have students bring in different kinds of flowers, dissect in class, locate the parts, and draw them. Do It Yourself: Compare different flowers, p.273. *Have students bring different kinds of fruits to class and demonstrate the seeds by cutting them open. Find Out More, p.270. Teaching Strategy for p.269, parts of flowers, T74. Teaching Strategy for p.270, compare other fruits to a tomato, T74. *Have students bring in seeds or flowers that have very noticeable structures for seed dispersal. Ex: cocklebur, dandelion.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	*This would be a good place to use the newspaper in the classroom. There are frequently articles on plant care with instructions that students could follow. (These could be put on tape for students with reading difficulties.) Also, a scrapbook could be made using these articles. Teaching Strategy for p.272, examine sunflowers, T75. Experiment: Flower Parts and Pollen Germination, included in guide.
Show and describe the process of seed germination.	Activity No. 21: Effects of Temperature on Seed Germination, pp.63-64, Activity Booklet. Investigate: Do treated seeds begin to grow faster than untreated ones?, p.267. Have students plant seeds at different depths, make observations, and hypothesize why some did not reach the surface. Have students examine seed packages for seed germination requirements. @To demonstrate other conditions for seed germination, have students design experiments testing varying conditions such as sunlight, air, water, and soil. Doing More, Question 1, p.283.
Distinguish between pollination and fertilization.	Go over section, "From Flower to Fruit," pp.269-270. Have students define pollination and fertilization.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	*Find pictures that give examples of agents of pollination (wind, water, insects, animals) or students could make drawings of ways pollination can occur. Have students examine different kinds of pollen grains in the microscope and write observations comparing the structure, size, and color. Have students spread pollen grains on top of a petri dish filled with a dilute sugar solution. Cover the dish, set aside for two days, then observe the pollen grains in the microscope. @Students can study conditions needed for pollen germination by varying the medium used in the petri dish. Possible substances may be water, vinegar, salt solution, and fruit juice. Find Out More, p.274.
Describe differences and similarities in monocotyledon and dicotyledon seeds and plants.	Do It Yourself: Decide which plants are dicots and which are monocots, p.279. Activity No. 22: Parts of a Seed Necessary for Germination. pp.65-68. Distribute copies of Seeds and Seed Dispersal Information Sheet, in guide. Have students complete Seeds and Seed Dispersal Worksheet, in guide. Soak bean seeds over night and have students examine seeds for seed coat, cotylendons and embryo plant. Examine other seeds for these parts, also. (Ex: raw peanuts, lima beans, black eyed peas, pinto beans, etc.) Teaching Strategy for p.276, Compare corn seed with peas or beans, T76. Teaching Strategy for p.279, Display foods of dicots and monocots, T76.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Recognize the methods used and the importance of producing new plant varieties.	Have a class discussion on the career section, Developing New Varieties of Plants, p.281. Have the students define hybrid plants. @Have students study by listing, defining, and researching: selective breeding, crossbreeding, artificial cross-pollination. @Write to the Agricultural Extension Service for news on hybrid plants. @Let students list as many relatively new hybrid plants, fruits, and vegetables as possible. Pictures would be good to show hybridization and how it improves the product.

FLOWER PARTS AND POLLEN GERMINATIONIntroduction

The angiosperms are the group of green plants that produce a reproductive structure called the "flower." The flower contains the reproductive parts, including the reproductive cells that ultimately develop into the embryo. This type of reproduction where a male nucleus unites with a female ovule to form an embryo is true sexual reproduction. Not all flowers are either male or female. If a flower has only the male sex organs or only the female sex organs, it is said to be "imperfect." If both male and female organs are on the same flower, it is said to be "perfect" and is sometimes able to fertilize itself.

All flowers do not contain pretty petals or fragrant scents to attract insects to aid in the fertilization process. Some do not contain protective structures. The flowers we generally think of are the conspicuous ones like the primrose, sweet pea, and orchid. Those we never notice, the inconspicuous ones, are the oaks, rice, oats, etc.

Objectives

To examine and carefully observe the parts of a "perfect" flower, to learn their correct names, to observe various pollen grains, and possibly to observe pollen tube germination and growth.

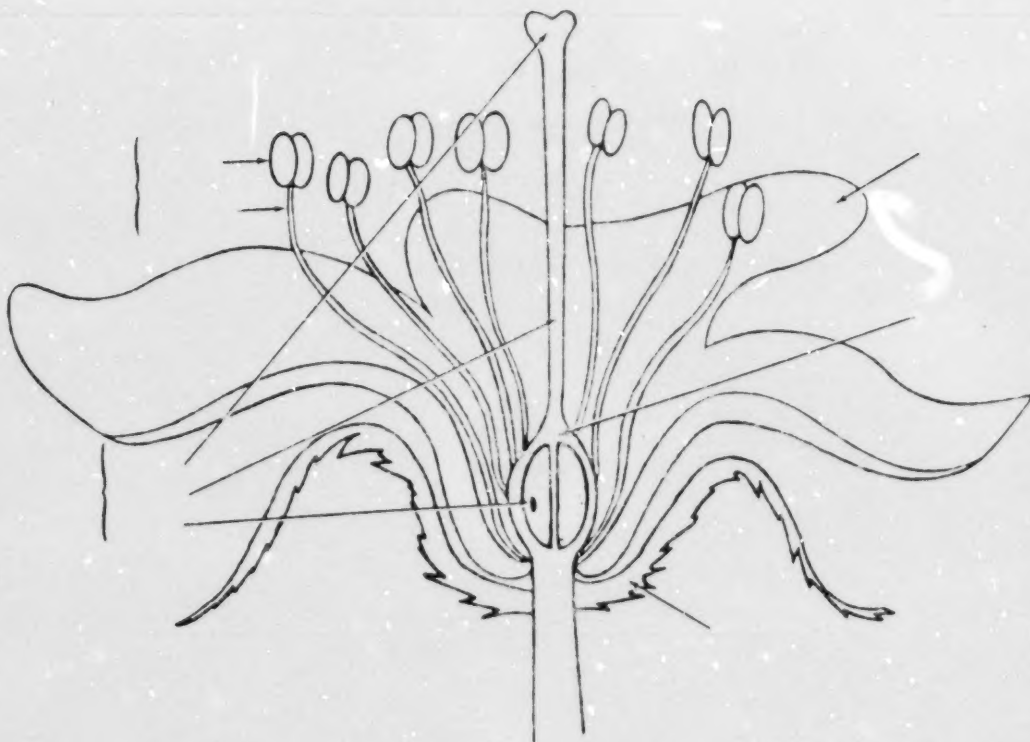
Materials

Dissecting microscope	Compound microscope
Freshly cut flowers	15% glucose (sugar)
(rose, tulip, lily,	water solution
primrose, pear or	Scalpel
peach blossom)	Forceps
Cover slips	Hand lens

Procedures

1. Take a flower by its stem and examine it. Rotate it and note the underneath green portion. Then spread its petals and look inside.
2. Use a hand lens or a dissecting scope to look at the details of the inside parts.
3. Make a longitudinal section of the entire flower. Identify and label on the diagram:

anther, filament, ovary, ovule, petal, pistil, sepal, stamen, stigma, style.



4. Pollen from various flowers germinates in different concentrations of the sugary substance found on the stigma. This concentration varies from 2 percent of one of the simple sugars to 40 percent. With your dropper place 1 drop of the 15 percent glucose solution on a slide. Use forceps to grasp the anther. Touch the anther to the drop until some pollen is in the solution. Cover with a cover slip. In 20 minutes search the field for pollen germination. Sketch the pollen tube below.

5. Detach a second anther and place it on a slide. Make a wet mount. Do you see any pollen? _____ Sketch a few pollen grains from the anther. Exchange positions with other members of the class examining pollen from different flowers. Sketch several types of pollen grains below. Label each with the name of its parent plant.

Note the comparative sizes and shapes of various pollens. Could the size and shape of pollen be used to identify classes of flowers? _____

Why could some types of pollen be more irritating to your respiratory system than others? _____

6. Examine several different flowers and complete the chart below:

Flower	Number of Sepals	Number of petals	Number of Stamens
1.			
2.			
3.			
4.			
5.			

Can you make a generalized statement correlating the information on this chart?

Questions:

1. Name a perfect flower.
2. Name an imperfect flower.
3. What is meant by "complete" flower?
4. What is meant by an "incomplete" flower?

VEGETABLES

PARTS OF PLANTS USED FOR FOOD

FRUITS

Apples
Apricots
Avocados
Bananas
Berries (all kinds)
Cantaloupes
Cherries
Cucumbers
Dates
Eggplant
Figs
Grapefruit
Grapes
Lemons
Limes
Olives
Oranges
Peaches
Pears
Peppers
Plums
Prunes
Pumpkins
Raisins
Squash
Tomatoes
Watermelon

LEAVES

Cabbage
Collard Greens
Lettuce
Mustard Greens
Onion Tops
Spinach
Tea
Turnip Greens

SEEDS

Beans
Wheat (seeds are ground
up to make flour)
Chocolate
Coconut
Corn
Nuts
Oats (mashed up and made
into cereal)
Peas
Rice

STEMS

Asparagus
Celery
Garlic
Onions

ROOTS AND TUBERS

Beets
Carrots
Potatoes
Radishes
Turnips
Yams (Sweet Potatoes)

Basic characteristic listing of over 200 garden flowers

Low-growing flowers for groundcover or border planting—less than eight inches tall

W = Warm season P = Perennial B = Bulb, Corm, Tuber, Rhizome C = Cool season A = Annual TP = Tender Perennial

Achimenes W, B
Ageratum W, A
Aquilegia, dwarf forms C, P
Antirrhinum (snapdragon) C, A
Begonia W, TP
Callistephus, dwarf asters W, A
Catharanthus (periwinkle) W, A

Centratherum (Manous Beauty) W, A
Celosia, dwarf cockscomb W, A

Chrysanthemum W, P
Cineraria (Dusty Miller) W, A
Coleus, dwarf forms W, A
Dahlia, dwarf forms W, B
Dianthus (Pinks, Sweet William, Carnations) W, A or P
Eschscholtzia (California Poppy) C, A
Gaillardia, dwarf forms W, A or P
Gerbera (Transvaal Daisy) W, P
Iberis, dwarf, Candytuft C, A or P
Impatiens, dwarf balsam W, A
Impatiens, dwarf sultanas W, TP

Lantana W, TP
Limnathes (Meadowfoam) C, A
Lobularia (Sweet Alyssum) W, A
Nemophila (Baby Blue Eyes) W, A

Nicotiana, dwarf forms W, A
Phlox, dwarf forms C, A
Petunia W, A

Portulaca (Rose Moss) W, A
Salvia, Dwarf forms W, A
Tagetes (Marigold) dwarf forms W, A
Torenia (Wishbone Flower) W, A
Viola (Pansy and Violas) C, A
Zinnia, dwarf forms W, A

Medium Tall Flowers—8-24 inches tall

W = Warm season P = Perennial B = Bulb, Corn, Tuber, Rhizome C = Cool season A = Annual TP = Tender Perennial

Alcea (annual hollyhocks) W, A
Aquilegia (Columbine) C, P
Calendula (Pot Marigold) C, A
Caladium W, B
Canna, Dwarf forms W, B
Catharanthus (periwinkle) W, A

Celosia (Cockscomb) W, A
Canaurea (Cornflower) C, A
Chrysanthemum W, P
Cineraria (Dusty Miller) W, A
Cosmos W, A
Dahlia W, B
Dianthus (carnations, Pinks) C, A or P
Digitalis, Var. Foxy Foxglove W, A

Dimorphothea (African Daisy) W, A
Echinacea (Purple Coneflower) W, P
Gaillardia (Blanket Flower) W, A or P
Gomphrena (Globe Amaranth) W, A

Helichrysum (Strawflower) W, A
Heliotrope W, A
Hemerocallis (Daylily) W, P
Impatiens (Balsam) W, A
Impatiens (Sultana) W, TP

Lathyrus (Dwarf Sweet Peas) C, A
Mignonette C, A
Mirabilis (Four O'clock) W, TP
Nicotiana (Flowering Tobacco) W, A
Phlox W, A or P
Salvia W, A or P
Statice W, A
Stokesia (Stoke's Aster) C, P
Rudbeckia (Gloriosa Daisy) W, P

Tagetes (Marigold) W, A
Veridium (Monarch-of-the-Veldt) W, A
Zinnia W, A

Tall Growing Flowers—24 inches and over

W = Warm season A = Annual C = Cool Season B = Bulb, Corm, Tuber or Rhizome P = Perennial TP = Tender perennial

Agrostemma (Corncockle) C, A
Alcea (Hollyhock) W, P
Amaranthus W, A
Antirrhinum (Snapdragon) C, A
Cleome (Spider Flower) W, A
Consolida (Larkspur) C, A
Coreopsis W, A
Cosmos W, A
Dahlia C, B
Digitalis W, P
Echinacea (Purple Coneflower) W, P
Gladiolus C, B
Helichrysum (Strawflower) W, A

Heliotropium (Heliotrope) W, A
Hemerocallis (Daylily) W, P
Hibiscus W, TP
Iris (Louisians, Pseudacoras) C, B
Mirabilis (Four O'clock) W, A
Nicotiana (Flowering Tobacco) W, A

Papaver (Poppy) C, A or P
Tagetes (Marigold) W, A
Tithonia (Mexican Sunflower) W, A
Zinnia W, A

Warm Season Flowers

*Especially Tolerant of High Temperatures

*Shade Plants

*Achimenes
Ageratum
Alcea (Hollyhock)
*Alternanthera
*Amaranthus
Ammobium (Winged Everlasting)
Anchusa (Summer Forget-Me-Not)
*Aphanostephus (Lazy Daisy)
*Begonia
*Caladium
*Catharanthus (Periwinkle)
Celosia (Cockscomb)
Cineraria (Dusty Miller)
Cleome (Spider Flower)
Coleus
Coreopsis
Cosmos
Digitalis
*Dimorphothea
Echinacea (Purple Coneflower)
Eustoma (Texas Bluebell)
*Gaillardia (Blanketflower)
Gazania
Gerbera
Gomphrena (Globe Amaranth)
Helichrysum (Straw Flower)
Heliotropium
Hemerocallis
*Hibiscus
Hippeastrum (Amaryllis)

*Impatiens (Sultanas and Balsam)
Lantana
*Lobularia (Alyssum)
*Mirabilis (Four O'clock)
Nicotiana (Flowering Tobacco)
Petunia
Phlox
*Portulaca (Rose Moss)
*Rudbeckia (Cone Flower)
Salvia

Cool Season Flowers

*Frost Sensitive
*Shade Plants
Agrostemma (Corn cockle)
Anemone
*Aquilegia (Columbine)
Antirrhinum (Snapdragon)
Calendula
Centaurea (Bachelor's Button)
Consolida (Larkspur)
*Dahlia
Dianthus (Pinks, Sweet Williams, Carnations)
Eschscholtzia (California Poppy)
*Gladiolus (including freesias, watsonsias, ixias, etc.)
*Iberis (Candytuft)
*Lathyrus (Sweet Pea)
*Limonium (Statice)
upinus (Texas Bluebonnet)
*Moluccella (Bells-of-Ireland)
Narcissus (Daffodils)
*Nemesia
Nemophila (Baby Blue Eyes)
Nigella (Love-in-a-mist)
*Pelargonium (Geranium)
Papaver (Poppy)
Ranunculus
*Salpiglossis
Stokesia (Stoke's Aster)
*Tropaeolum (Masturtium)
Viola (Pansy, Viola, Johnny-Jump-Up)

Flowers for Hanging Baskets

W = Warm Season C = Cool Season S = Shade Plants T = Definite Trailing Habit
Achimenes W, S, T
Ageratum W
Ageratum W
Aphanostephus (Lazy Daisy) W, T
Begonia W, S

Flowers for Hanging Baskets

W = Warm Season
C = Cool season
S = Shade Plants
T = Definite Trailing Habit
Achimenes W, S, T
Ageratum W
Aphanostephus (Lazy Daisy) W, T
Begonia W, S
Catharanthus (Periwinkle) W, T
Cineraria (Dusty Miller) W
Colcus W
Eschscholtzia (California Poppy) C
Gaillardia (Blanketflower) W
Gazania W, T
Iberis (Candytuft) W
Impatiens (Sultana) W, S
Lantana W, T
Lobularia (Alyssum) W, T
Lupinus (Texas Bluebonnet) C, T
Nemesia C
Nemophila (Baby Blue Eyes) C, T
Pelargonium (Trailing Geraniums) C, T
Petunia (Cascade Petunia) W, T
Portulac (Rose Moss) W, T
Stokesia (Stoke's Aster) C, T
Tropaeolum (Nasturtium) C, T
Verbena W, T
Viola C

PARTS OF A FLOWER

PURPOSE:

To learn about the structure and functions of flowers.

MATERIALS:

Microscope, blank slides, forceps, prepared slide of germinating pollen grains, two simple flowers, hand lens or tripod magnifier.

EXPLANATION:

Flowers are the reproductive structures of a group of spermatophytes called angiosperms. Flowers are specialized to carry on the following processes:

1. Male and female gametes are formed in the flower.
2. Fertilization occurs in the flower.
3. The zygote is enclosed within a seed formed by the flower.
4. The seed germinates to produce a new plant.

In order to understand how the flower carries out its function of reproduction, we must study its structure. A typical flower has four main structures:

1. The Calyx. This is a circle of tiny green leaves, called sepals, which can be found at the base of a typical flower. The calyx provides protection for the flower when it is in the bud.
2. The Corolla. Just above the calyx is a circle of modified leaves, called petals. The entire circle of petals is called the corolla. The corolla is usually brightly colored and scented. It serves to attract insects.
3. The Stamens. Inside the corolla is a group of stalklike structures topped with a yellowish or orangish powder called pollen. These structures are the male reproductive organs, called stamens. Each stamen is composed of two parts, as follows:
 - a. The filament, a stalklike structure which supports the anther.
 - b. The anther, the topmost part of the structure, in which the pollen is produced.
4. The Pistil. In the center of the flower is the pistil, the female reproductive organ. It has three functional parts, as follows:
 - a. The stigma, which is the uppermost part of the pistil. It is coated with a sticky substance which catches and holds the pollen grains.

- b. The style is a hollow tube which supports the stigma and provides a path for the pollen to reach the ovary.
- c. The ovary is the enlarged structure at the base of the pistil. It contains ovules which develop the female sex cells or ova.

Fertilization occurs when the male gamete, a pollen grain, unites with the female gamete, an ovule. As a result of this fertilization, a zygote is formed which develops into an embryo, or seed. The seed, when planted in a moist place with adequate sunshine, will develop into a new plant.

PROCEDURE: The structure of a Flower

1. Bring two simple flowers to school with you. Be sure to keep them in a plastic bag with a small amount of water, to keep the flowers from wilting.
 2. Using the hand lens or tripod magnifier, study the overall structure of one flower.
 3. Gently pull off the sepals with forceps. Count them and record the data in the table under Item 1, Observations and Conclusions.
 4. Gently pull off the petals, count them, and record the data in Item 1, Observations and Conclusions.
 5. Pull off the stamens, count them, and record the data in Item 1, Observations and Conclusions.
 6. Cut a cross section of the ovary (lower part of pistil) with the scalpel. Study this cross section with the hand lens or tripod magnifier and make the drawing indicated in Item 2, Observations and Conclusions.
 7. Briefly examine the other flower and repeat steps 3, 4, and 5 above. Record the data in the table under Item 1, Observations and Conclusions.
 8. Cut a longitudinal (lengthwise) section of the pistil. Study the longitudinal section of the pistil with the hand lens or tripod magnifier. Make the drawing indicated in Item 3, Observations and Conclusions.
 9. Study one of the stamens with a hand lens or tripod magnifier. Make the drawing indicated in Item 4, Observations and Conclusions.
 10. Dust a few pollen grains onto a glass slide (do not wet or cover) and examine them under low and high power of the microscope. Make the drawing indicated in Item 5, Observations and Conclusions.
 11. Obtain a prepared slide of germinating pollen grains and study them under low and high power of the microscope. Make the drawings indicated in Item 6, Observations and Conclusions.
- Answer Item 7.

WORKSHEET

PARTS OF A FLOWER

OBSERVATIONS AND CONCLUSIONS:

1. Record your data in the appropriate column of the chart below:

Specimen	No. of Sepals	No. of Petals	No. of Stamen
1st Flower			
2nd Flower			

2. Make a drawing of a cross-section of the flower ovary.
3. Make a drawing of a longitudinal section of the flower pistil.
Label the stigma, style, ovary, and ovules.

4. Make a drawing of a single stamen and label the filament and the anther.
5. Draw several pollen cells.
6. Make a drawing of a pollen grain that is not germinating, and a drawing of one with a pollen tube.
7. How many nuclei does a pollen grain have? Why?

QUESTIONS FOR RESEARCH:

1. What are some of the different methods of pollination, and how is each accomplished?
2. What happens to the different parts of a flower after the ova have been fertilized?
3. What is meant by the terms staminate flowers and pistillate flowers?
4. State fully the difference between:
 - a. a spore and a seed
 - b. a gamete and a zygote
 - c. an ovule and a plant embryo
 - d. conjugation and fertilization

INFORMATION SHEET

SEEDS AND SEED DISPERSAL

PURPOSE:

To study the structure and functions of fruits; to study the structure and stages in germination of typical dicot and monocot seeds; and to study special adaptations of seeds for dispersal.

MATERIALS:

Hand magnifier (hand lens or tripod magnifier), scalpel, 2 beakers, lima bean seeds, large corn seeds, an apple (brought by the student), student collections of seeds from their neighborhoods

EXPLANATION:

Before reading the following, review the explanation given on the PARTS OF A FLOWER WORKSHEET.

A seed is a ripened ovule. From the moment of fertilization, an egg begins a series of divisions that continue until the embryo is formed. An embryo (seed) consists of the following structures:

1. The Plumule. This structure forms the stem and leaves of the new plant.
2. The Hypocotyl. This structure forms the roots of the new plant.
3. The Cotyledon. This structure is the stored food required by the embryo until it develops mature leaves. (Monocot seeds have one cotyledon, and dicot seeds have two cotyledons. Monocots, however, have a specialized structure, the endosperm, which contains most of the stored food. The endosperm is often missing in dicot seeds; when found, it is usually very small.)

When the above structures have been formed, the seed goes into a resting stage. During the resting stage the seed forms its outer covering, or seed coat; at the same time the ovary develops into a fruit. When the seed coat has been formed and the ovary has ripened, the seed is ready for dispersal.

It is not to the plant's advantage to drop its seeds near itself, because it would then be competing with its offspring for water, minerals, and sunlight. Therefore, most plants have developed specialized types of fruits and seeds to provide for greater seed dispersal. These adaptations for dispersal can be grouped into three primary classes:

1. Adaptations for dispersal by wind. Examples are maples, pines, milkweeds, dandelions, thistles, touch-me-nots.

2. Adaptations for dispersal by water. Examples are coconuts and various kinds of weeds.
3. Adaptations for dispersal by animals. Examples are fruits which are edible and thus are carried far from the parent plant by the animals which eat them. Others, such as sand burrs and cockleburs, have dried fruits which become attached to the skin and fur of animals and are carried great distances from the parent plant.

Once the seeds have been dispersed, those which land in a spot in which there is suitable warmth, sufficient moisture, and enough oxygen begin to germinate (develop). In the initial stages of germination, the hypocotyl begins to grow and develops the primary root. Then the plumule begins to develop into the stem and leaves. Thus it is that a new plant is born in a spot far from the parent plant.

PROCEDURE I: The Structure of Fruits

1. Work in pairs during this experiment, using the apples brought by the students for study.
2. Cut a cross-section of one of the apples and study it with a hand lens or tripod magnifier. Attempt to identify the structures of the flower that have been modified to become a part of the apple. Such structures are the receptacle, the ovary, and the calyx. Make the drawing indicated in Item 1-a, Observations and Conclusions.
3. Cut a longitudinal section through the core of another apple. Observe the section with the magnifier and attempt to identify the structures in Step 2. Make the drawing indicated in Item 1-b, Observations and Conclusions.

PROCEDURE II: Structure of a Sprouting Bean Seed

1. Soak some lima bean seeds in water overnight.
2. Remove the seed coat, or testa, and gently pull the two halves apart.
3. Study the split dicot seed with a hand magnifier and identify the hypocotyl, the plumule, and the cotyledons. Make the drawing indicated in Item 2, Observations and Conclusions.

PROCEDURE III: Structure of a Corn Seed

1. Soak several large corn seeds in water for one or two days.
2. Remove one of the seeds and carefully cut a longitudinal section with a scalpel.

3. Examine the longitudinal section of the corn seed with a hand magnifier and make the drawing indicated in Item 3, Observations and Conclusions.

PROCEDURE IV (OPTIONAL): Dicot Seed Germination

1. Place some of the bean seeds you soaked for Procedure II in damp sawdust or vermiculite. Keep the seeds moist, but not wet.
2. Remove one sprouting seed every two or three days; examine it with a hand magnifier and note the development of the hypocotyl and the plumule.
3. Make a series of drawings to indicate these stages of development, as indicated in Item 4, Observations and Conclusions.

PROCEDURE V (OPTIONAL): Monocot Seed Germination

Follow the procedure outlined in Procedure IV, this time using some of the corn seeds. Make the series of drawings indicated in Item 5, Observations and Conclusions.

PROCEDURE VI: Adaptation for Seed Dispersal

1. Bring to school as many different kinds of seeds as you can find around your neighborhood.
2. Your teacher will make arrangements for three "stations" in the classroom. One station will be labeled "Adaptations for Dispersal by Wind"; another will be labeled "Adaptations for Dispersal by Animals"; and another will be labeled "Adaptations for Dispersal by Water."
3. Place each of your seeds at the station which you believe best fits its method of dispersal. Lay each seed on a small piece of paper. If possible, write the name of the plant from which you obtained the seed.
4. After each student has placed his seeds at the appropriate stations, your teacher will check them for correctness. You will then be given an opportunity to examine the seeds at each station. Carry a pencil and a piece of notepaper with you to get the necessary information for answering Item 6, Observations and Conclusions.

SEEDS AND SEED DISPERSAL

OBSERVATIONS AND CONCLUSIONS:

1. Make the drawings indicated below and label the following structures if they are visible in the section indicated:
calyx, receptacle, and ovary.

a. Cross-section
of apple

b. Longitudinal Section
of apple

2. Make a drawing of a split dicot seed and label the cotyledons, the plumule, and the hypocotyl.

3. Make a drawing of a longitudinal section of a monocot seed and label the endosperm, the hypocotyl, and the plumule.

4. Make a series of four to six drawings to illustrate the stages of development of a dicot seed (from your observations in Procedure III, Chart JBS 10, or from page 315, Adventures in Science).

a. _____ Day of
Development

b. _____ Day of
Development

c. _____ Day of
Development

d. _____ Day of
Development

e. _____ Day of
Development

f. _____ Day of
Development

5. Make a series of drawings to show the stages in the germination of a monocot seed.

a. _____ Day of
Development

b. _____ Day of
Development

c. _____ Day of
Development

d. _____ Day of
Development

e. _____ Day of
Development

f. _____ Day of
Development

6. Make a drawing of a type of seed that illustrates each of the following three adaptations for seed dispersal.

a. Wind

b. Animals

c. Water

7. Your class probably found few if any seeds representing one of the types of dispersal. How can you account for this?

QUESTIONS FOR RESEARCH:

1. List some of the economic values of fruits.
2. List some of the economic values of seeds.
3. Examine various types of fruits (oranges, pea-pods, etc.). Make a drawing of each of them and label the structures of the flower represented in each fruit.
4. Make three pocket gardens by placing bean seeds between paper toweling in three pint jars. Moisten the toweling in two of them, but not in the third one. Add a few drops of water each day to the two you have moistened. Place one moist pocket garden and the dry pocket garden in a place where there is adequate sunlight for growth. Place the other moist pocket garden in a dark place. Examine them from day to day and answer the following questions:
 - a. What happened to the moist seeds placed in the dark?
 - b. What happened to the moist seeds placed in sunlight?
 - c. What happened to the dry seeds placed in sunlight?
 - d. What can you conclude about the conditions necessary for seed germination?

UNIT 8

ADDICTIVES: ALCOHOL, TOBACCO, AND DRUGS

Time Allotment
10 days for entire unit

Since this textbook does not have any chapters dedicated to the study of this unit, all material used will come from outside sources. Your chairperson has a file on all the pamphlets and sources issued by the district. Order blanks are included for your use. Following will be the objectives to be covered for this unit.

Major Concepts to be taught:

- Development of alcohol
- Development of tobacco
- Development of drugs

Instructional Objectives:

The student should be able to -

- Explain the classification of drugs.
- Identify tobacco and associate abnormal body symptoms and illnesses with smoking.
- Identify alcohol and associate abnormal body symptoms and illnesses with drinking.
- Identify narcotics, barbituates, amphetamines, and hallucinatory drugs and associate them with abnormal body symptoms and illnesses.
- Recognize the importance of drugs when taken properly under a doctor's supervision.

Assessment:

The student will:

- Define the word "drugs."
- Name the main ingredient in tobacco which affects the body.
- Define carcinogen.
- Name diseases other than lung cancer which are associated with cigarette smoking.
- Explain the connection between smoking and lung cancer.
- Explain the difference between ethyl and methyl alcohol.
- Explain why alcohol is classified as a depressant.
- List illnesses associated with alcoholism.
- Define narcotic.
- Define addiction.
- Explain why narcotic addiction is harmful to health.
- Define barbituate.

Explain how barbituates are both helpful and harmful.
Explain the effect of amphetamines on the body.
Define hallucinatory drug, illusion, hallucination.
Explain why P.C.P. is a dangerous and harmful drug.
List the general and proper use for these drugs: stimulants,
depressants, narcotics.

Materials:

"This Side Up: Making Decisions About Drugs", National Institute on Drug Abuse

"Drug Abuse Prevention", National Institute on Drug Abuse

"Alcoholism", prepared by Texas Alcoholism Prevention Foundation, Inc.

See Resource Materials List prepared with addresses for your use at the beginning of this guide.

Films:

- M6032 - Alcohol: A New Focus, 15 minutes
- L6022 - Alcohol Problem: What Do You Think?, 18 minutes
- M5854 - Drugs and the Nervous Center, 18 minutes
- M6033 - Smoking, A New Focus, 15 minutes
- 4697 - Smoke, Anyone, 9 minutes
- M7308 - Alcohol, Tobacco, and Drugs: Physical Fitness, 22 minutes
- 4987 - Drugs: Use or Abuse, 10 minutes
- M6436 - Health Wreckers, 13 minutes

Charts:

Obtain a drug chart from a pharmaceutical company.
The Nervous System, Human

Models:

The Brain

Suggested Activities:

Make posters for these topics.
Have guest speakers from Alcoholics Anonymous, Pharmaceutical Society, or March of Dimes come to speak to your group.
Have your local policeman come in a talk about laws on drugs for juvenile offenders.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Understand the classification of drugs.	Define: <u>antibiotics</u>, <u>stimulants</u>, <u>depressants</u>, <u>narcotics</u>, <u>habit forming drugs</u>, <u>non-habit forming drugs</u>, <u>addiction drugs</u>. (This may be done in the form of a matching study sheet, "teacher made" game, or as a lab. Example: have a fairly well-known brand of vitamins, aspirin, prescription bottles, etc... EMPTY, please.) See if students can match labels and containers to the type of drug mentioned. Xerox prescription labels from old bottles and have the students examine them to see if all the correct information is included. Students can find the most current information on drugs in <u>Today's Health</u> or from the newspaper. *Using favorite articles from the <u>Reader's Digest</u> or any straight-forward source of drug information, make a tape for students to listen to. Use "This Side Up: Making Decisions About Drugs" as a workbook.
Identify tobacco and associate abnormal body symptoms and illnesses with smoking.	Discuss with students the reasons why people smoke. Have students collect and analyze cigarette advertisements. Ask the students to explain how the ads are made to appeal to the public. Write to the American Cancer Society to obtain information concerning the link between cigarette smoking and cancer. Obtain information from the American Heart Association on smoking and circulatory disease.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will --	*Make a bulletin board showing specifically what nicotine does to the body.
Identify alcohol and associate abnormal body symptoms and illnesses with drinking.	*Have the students bring a small toad or frog from home. Place the frog on its back and observe how it rights itself. Then, put the frog in an inch of alcohol for one minute, remove and place on its back. Observe any difference in coordination as the frog rights itself. Students should wash off the frog and return it to a natural environment. Obtain information from Alcoholics Anonymous. Read over "Alcoholism" and discuss in class. *Make a bulletin board showing specifically what alcohol does to the body. Invite someone from police department to demonstrate the breathalyzer test.
Identify narcotics, barbiturates, amphetamines, and hallucinatory drugs and associate them with abnormal body symptoms and illnesses.	Obtain from a pharmaceutical company a "card chart" on drugs and their effect on the body. *Have a police officer or lawyer talk to the students about the drug problem as related to the law. *Students can make posters on drug abuse; display these in the school clinic and in the gym area. Make a bulletin board to illustrate what barbiturates, amphetamines, and hallucinatory drugs do to the body.

PERFORMANCE OBJECTIVES	SUGGESTED ACTIVITIES
The student will -- Recognize the importance of drugs when taken properly under a doctor's supervision.	Have a pharmacist come and talk to the class on the proper uses of drugs. He could also discuss the training required to become a pharmacist. *Have a special lesson on reading labels keeping prescription drugs and "over the counter" drugs out of the reach of small children. NOTE: This unit represents an area of concern to the schools and the community. Use your common sense in presenting materials. <u>Many students come from homes where alcoholism and drug abuse are real problems and very much a part of their lives. Present the facts, offer counseling and guidance if sought, and avoid "pointing the finger" at students who brag about smoking, drinking, or using drugs.</u>

APPENDIX

LEARNING TO CONSTRUCT A SIMPLE GRAPH

BACKGROUND:

A graph is a diagram showing relationships between two or more factors. It is often used to present facts so that they will be clearer and easier to understand.

In Science much of our material can be more easily understood if it is depicted on a graph. Therefore, it is essential that each student in Science be able to construct, plot and interpret simple graphs.

MATERIALS NEEDED:

Unlined paper, ruler, colored pencils.

PROCEDURE:

You will construct a simple graph and plot points on it by following the instructions listed below:

1. Draw six (6) horizontal lines as follows: COLOR THESE BLUE.
 - (a) Ten (10) inches long
 - (b) One (1) inch apart
 - (c) Label consecutively from bottom to top, 0-5.
 - (d) Draw a long horizontal arrow at the bottom of the page, pointing toward the right. Label it Horizontal Axis.
2. Draw six (6) vertical lines as follows: COLOR THESE RED.
 - (a) Six (6) inches long
 - (b) Two (2) inches apart
 - (c) Label consecutively from left to right, 0-5.
 - (d) Draw a long vertical arrow along the left side of the page, pointing toward the top of the page. Label it Vertical Axis.
3. Your graph ordinates are now complete. You will now plot in your coordinate points. Please refer to the Graph Data Tables A and B. Plot the graph points according to the instructions given at the bottom of the Data Sheet.

THINGS TO REMEMBER:

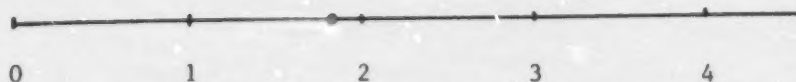
Horizontal scale (ordinate) or horizontal axis is from left to right on your paper.

Vertical scale (ordinate) or vertical axis is from top to bottom of your paper.

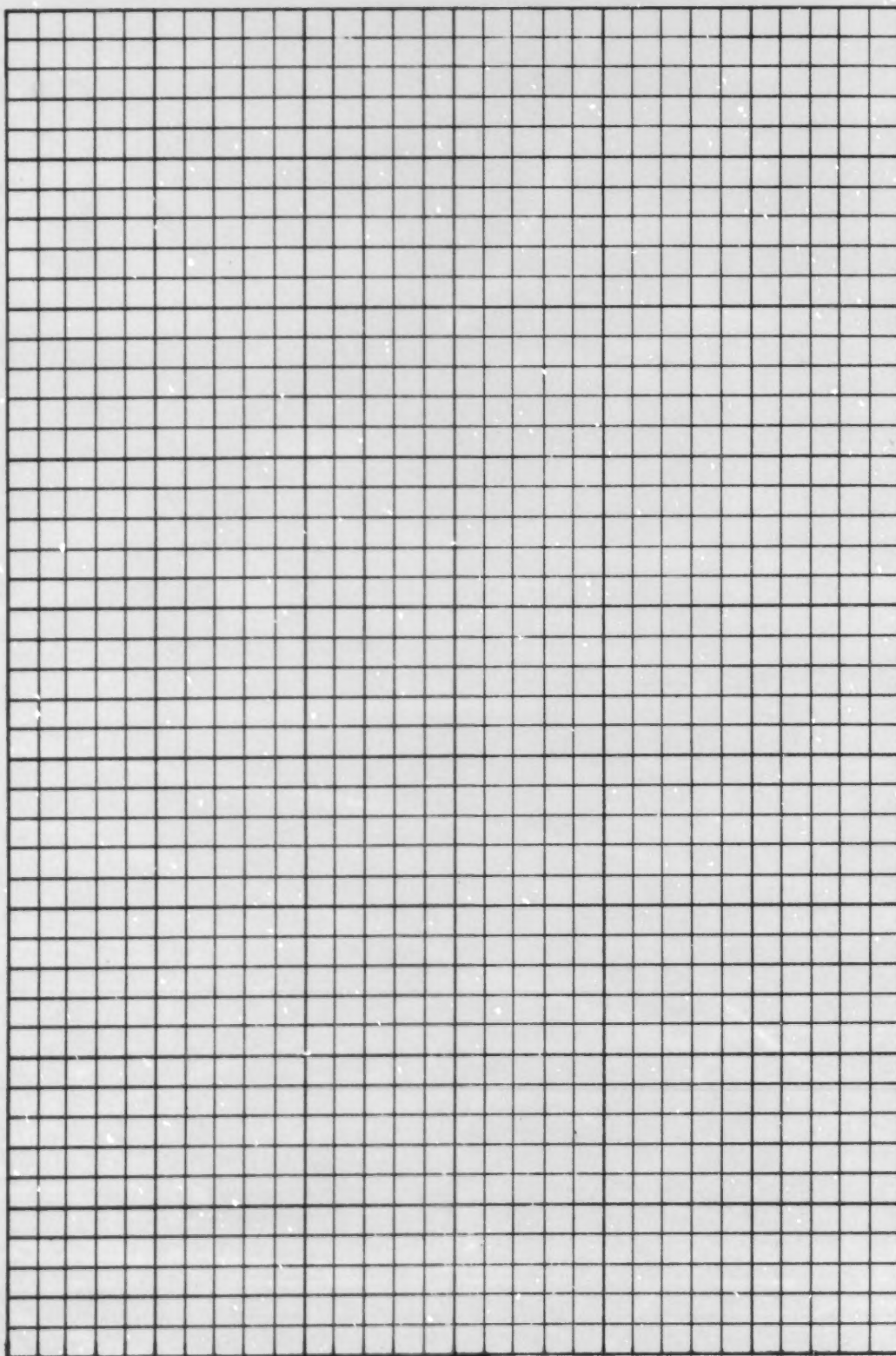
Points (coordinates) on your graph must be plotted according to BOTH horizontal and vertical scale. A point will be marked only where these two scales INTERSECT.

Between the number values actually marked on your graph, there will be other intermediate numbers that are not marked. Many times in marking your ordinate points, you must estimate the location of these numbers. For example:

(.1 - .9 are not actually marked on graph. Must estimate.)



• Would be the estimated position of 1.8



GRAPH DATA TABLES

A

TABLE A

Points	Horizontal	Vertical
A	0	0
B	.5 ($1/2$)	1
C	1	1
D	2	3
E	2.5 ($2\frac{1}{2}$)	4
F	3	2.5 ($2\frac{1}{2}$)
G	3.5 ($3\frac{1}{2}$)	2.5 ($2\frac{1}{2}$)
H	4	5
I	4.4	4
J	4.8	1

B

TABLE B

Points	Horizontal	Vertical
A	0	1
B	1	1.5 ($1\frac{1}{2}$)
C	1.5 ($1\frac{1}{2}$)	4
D	2	4.5 ($4\frac{1}{2}$)
E	2.5 ($2\frac{1}{2}$)	1
F	3.5 ($3\frac{1}{2}$)	1.5 ($1\frac{1}{2}$)
G	4	2
H	4.4	1
I	4.5 ($4\frac{1}{2}$)	.5 ($\frac{1}{2}$)
J	4.8	0

COLOR CODE INFORMATION

- Plot each point in TABLE A on your graph in GREEN.
 - Using your ruler, draw a SOLID BLACK LINE connecting each successive point.
- Plot each point in TABLE B on your graph in BLACK.
 - Using your ruler, draw a BROKEN GREEN LINE connecting each successive point.

CHRISTMAS GRAPHS

I. Plot these points on your graph paper, connect them in the order they are listed.

<u>horizontal</u>	<u>vertical</u>
18	39
13	35
16	35
10	31
15	31
7	27
14	27
4	23
13	23
1	19
16	19
16	15
20	15
20	19
35	19
23	23
32	23
22	27
29	27
21	31
26	31
20	35
23	35
18	39

Number your paper from
0 to 38 on horizontal
0 to 50 on vertical

II

<u>horizontal</u>	<u>vertical</u>
11	43
22	43
26	33
15	33
11	43
11	22
15	12
26	12
26	33
15	33
15	12

connect all above points

7	24
11	28
10.5	29.5
11	31
7	35
11.5	36
16	35
13	31
13.5	29.5
13	28
16	24
11.5	23
7	24

Number your paper from
0-38 on horizontal
0-50 on vertical

III.

<u>horizontal</u>	<u>vertical</u>
13	30
17	30
17	15
23	15
22	12.5
21	11.5
20	11
10	11
8	11.5
7	12.5
6	15
13	15
13	30

connect above points

14	31
13.5	32.5
13	33
13	34
13.5	35.5
14	36
15	37
16	36
16.5	35.5
17	34
17	33
16.5	32
16	31
14	31

Number your paper from
0-38 on horizontal
0-50 on vertical

IV.

<u>horizontal</u>	<u>vertical</u>
13	35
11	14
13	10
21	4
25	6
26	9
19	13
21	34
13	35

connect above points

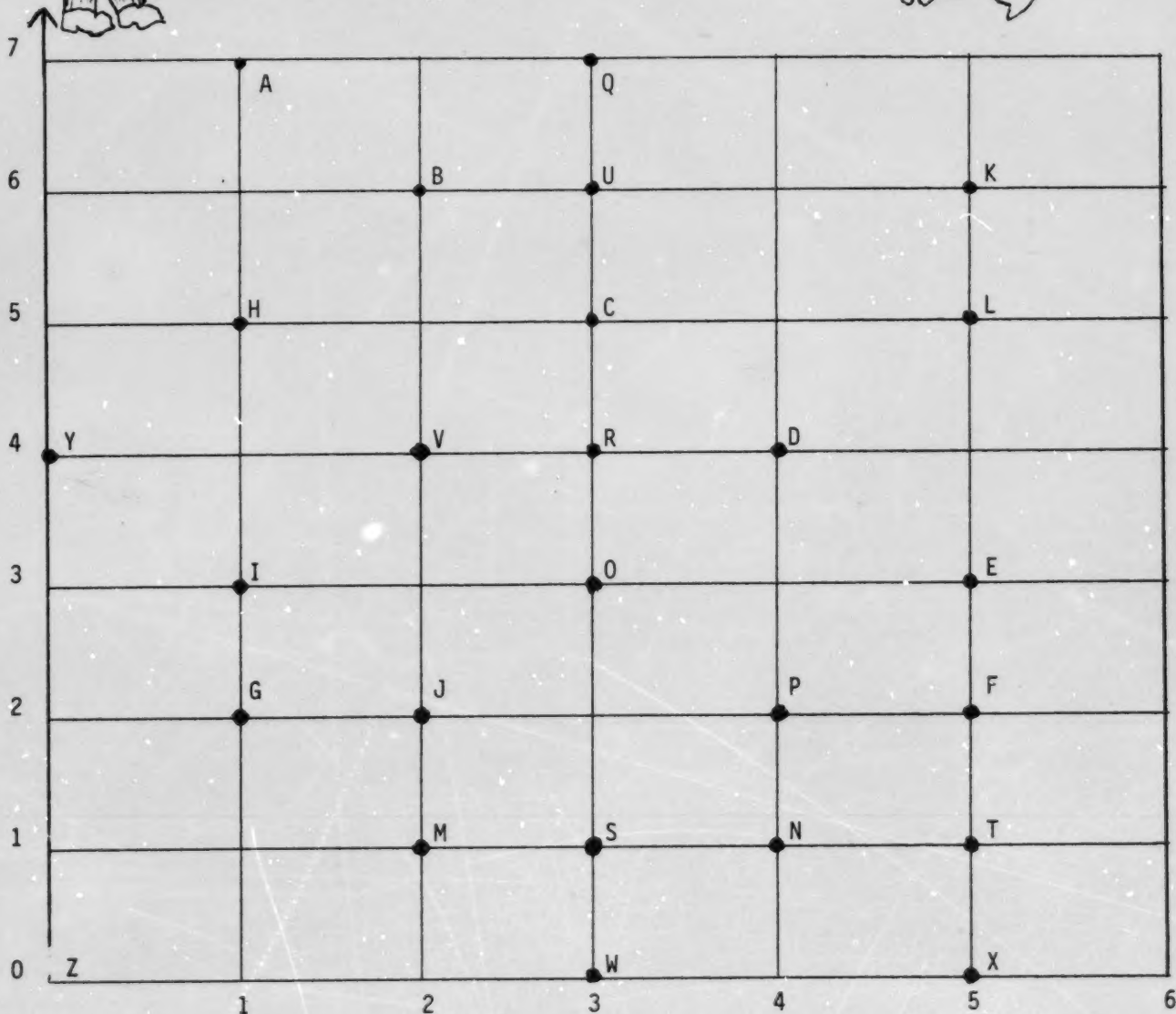
17	35
22	40
24	41
25	41
26.5	40.5
27	40
27.5	39
28	38
27.5	37
27	36
26	35
24.5	36
25.5	37
24.8	38
25	38.5
24	38.5
23	38
22	37
21	36
20	35

Number your paper from
0-35 on horizontal
0-50 on vertical



Make your own secret messages using the graph codes.

SECRETS



Put the letters at different places with a colored pencil and have your special friend make a copy. Then the two of you can have a special code.

SOME DISEASES AFFECTING VARIOUS SYSTEMS

Circulatory

anemias
aneurysms
arteriosclerosis
cardiac failure
congenital heart defects
coronary heart disease
embolisms
hemiphilia
leukemias
myocarditis
phlebitis
thrombosis
valvular heart disease
varicose veins

Digestive

appendicitis
cirrhosis (of the liver)
colitis
constipation
diarrhea
gastritis
hepatitis
indigestion
peptic ulcer

Endocrine

dwarfism
giantism
goiter
hypogonadism
and other hormonal
imbalances

Excretory

nephritis
nephrosis
uremia
urethritis

Nervous

encephalitis
epilepsy
general paresis (syphilis)
meningitis
multiple sclerosis
neuralgia
neuritis
neuroses
paralysis
poliomyelitis
psychoses

Reproductive

dysmenorrhea and other
gynecologic disorders
gonorrhea
prostatitis
syphilis
vaginitis

Respiratory

bronchiectasis
bronchitis
emphysema
laryngitis
pharyngitis
pleurisy
pneumonia
pneumonitis
rhinitis
sinusitis
tuberculosis

Skeletal

arthritis and rheumatism
muscular dystrophy
osteomyelitis
osteoporosis
rheumatic fever

SOME COMMON DISEASES

INFECTIOUS

Bacterial

blood poisoning
boils
botulism
chloera
diphtheria
dysentary (some types)
gonorrhea
leprosy
meningitis, meningococcal
peridontitis
pneumonia, pneumococcal
scarlet fever
strep throat
tetanus
tooth decay
tuberculosis
typhoid
whooping cough

Viral

chicken pox
common cold (?)
fever blisters
hepatitis
influenza and related
infections
measles
mumps
pneumonia, viral
poliomyelitis
rabies
shingles
small pox
yellow fever

Fungal (including yeasts)

athlete foot
dysentary, monilial (yeast)
jockey itch
ringworm
thrush (yeast)
vaginitis, monilial (yeast)

Protozoal

African sleeping sickness
dysentary, amoebic
malaria
syphilis

Metazoal

hookworms
pinworms
roundworms
trichinosis

NONINFECTIOUS

Anemias
Arthristis (nonseptic)
Cancers (?)
Cardiovascular diseases
Diabetes
Hormonal imbalances
Psychiatric disturbances
Ulcers
Tumors, benign
Vitamin (and other
difficiencies)

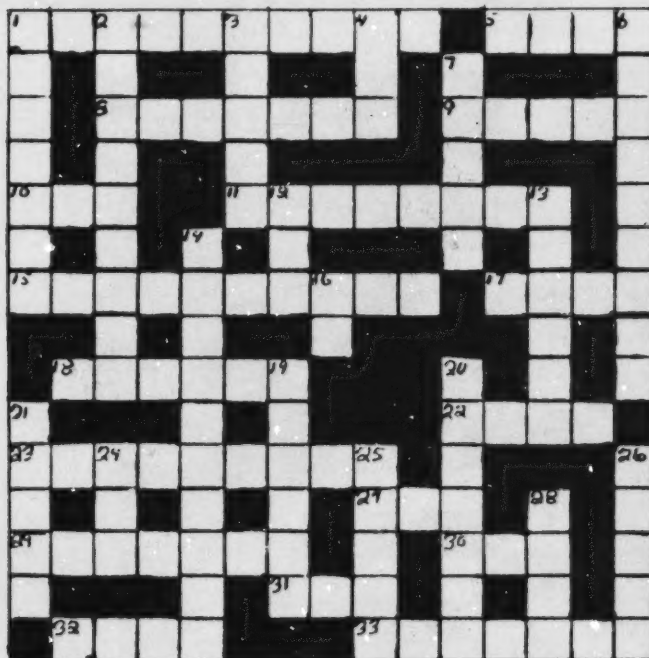
Skin

pruritis (various causes)
ringworms
stings, bites and
 other trauma
urticaria

All Systems

cysts
infections
nutritional diseases
parasitic infestations
traumatic injury
tumors, cancerous and
 benign

ORGAN SYSTEMS



CROSSWORD PUZZLE
No. 1

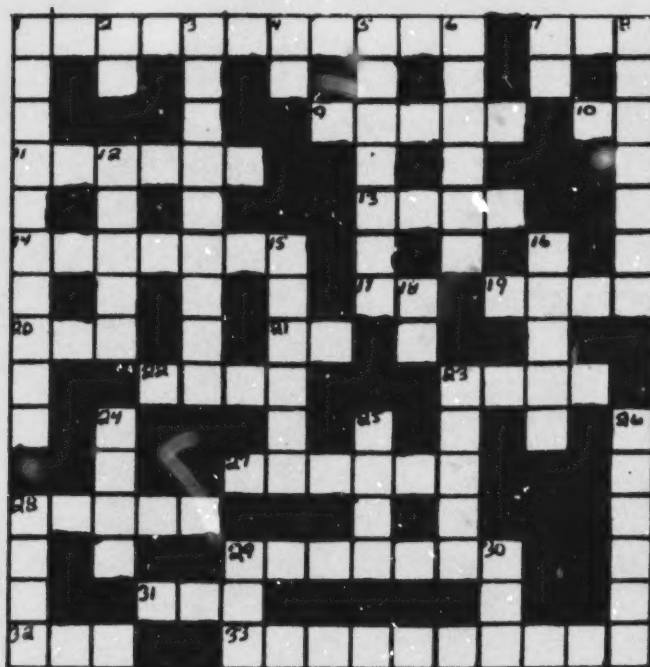
Across

1. canal in body that food goes through
5. fluid secreted by liver
8. gland which regulates body growth
9. proteins are made up of _____ acids
10. Autonomic nervous system
11. female sex hormone
15. covering over windpipe when swallowing
17. organs in which air is exchanged
18. layer of skin just below epidermis
22. a small circular band
23. point of attachment of a muscle
27. hardy cereal grass
29. serving as centers from which nerve impulses are transmitted
30. the self
31. side away from the wind
32. Lipids
33. point of contact between neurons

Down

1. enzyme changing starch to sugar
2. lower part of alimentary canal
3. fibers connecting body organs with central nervous system
4. a primary color
6. pharynx to the stomach
7. opposite of small
12. opposite of stand
13. structural and functional unit of the nervous system
14. dense ball of capillaries in kidney
16. titanium—symbol
19. of or having to do with the spine
20. chain of amino acids
21. a natural joint—as bivalve shell of clam
24. a male child
25. enlargements of lymph system
26. fluid containing urea and other waste products
28. Henle's _____ is found in the nephron of the

ORGAN SYSTEMS



CROSSWORD PUZZLE

No. 2

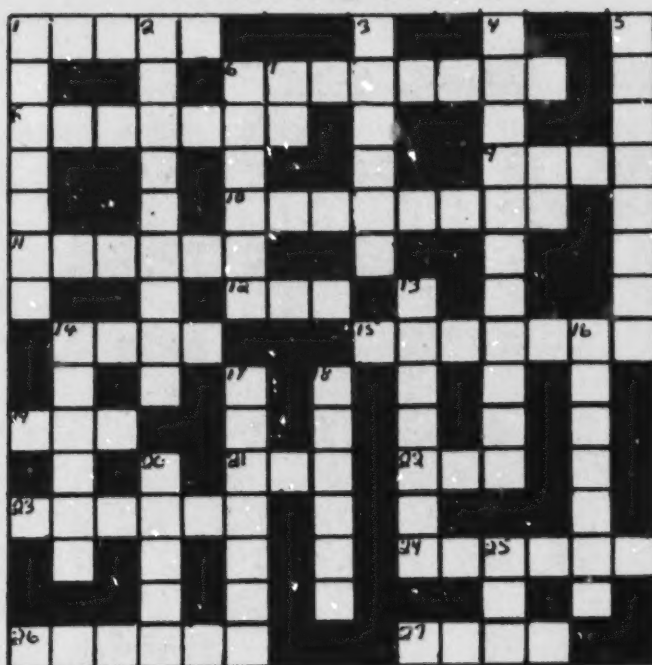
Across

1. wavelike motion of walls of alimentary canal
7. bowlike curved ine
9. nerve carrying impulses from CNS to muscle
10. blood type
11. of the stomach
13. adrenocorticotrophic hormone
14. two great arteries of neck
17. symbol of Holmium
19. any round object used to play a game
20. male turkey
21. symbol for silicon
22. small two-winged insects
23. lower end of alimentary canal
27. any muscle that bends a limb
28. fluid containing urea and other waste products
29. of the head or cranium
31. persons to whom one is speaking
32. antidiuretic hormone
33. breathing out

Down

1. cell which ingests and destroys other cells
2. agglutinating factor
3. the act or process of secreting
4. valves between atrium and ventricle
5. saclike organ into which food passes
6. muscle type in intestinal tract
7. blood type
8. same as 29 across
12. clear, yellowish fluid which separates from the clot when blood coagulates
15. terminal; opposed to proximal
16. cranial nerve - innervating heart, esophagus and most abdominal organs
18. blood type
23. the main artery of the body
24. vessels carrying blood back to heart
25. part of nerve cell through which impulses travel away from the cell body
26. insoluble protein formed from fibrinogen
28. soluble crystalline solid found in urine of mammals
29. rod used in pool
30. past participle of light

ORGAN SYSTEMS



CROSSWORD PUZZLE
No. 3

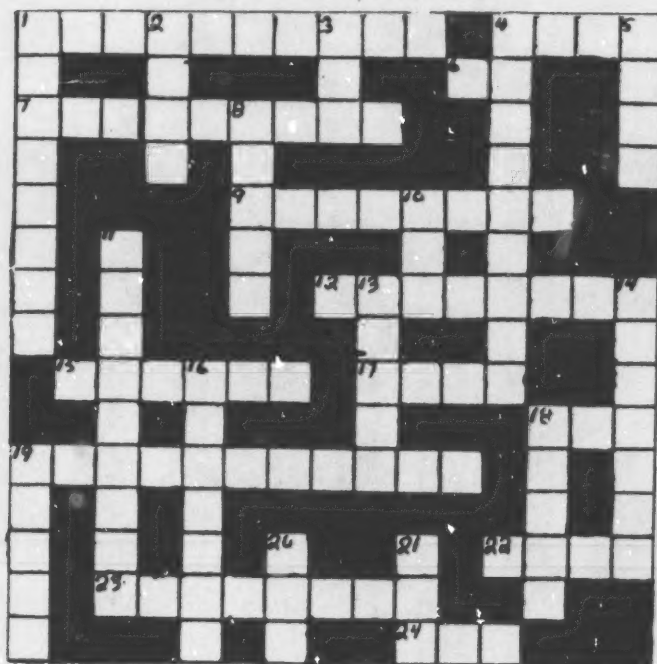
Across

1. one of the three ear bones
6. air cell of a lung
8. canal through which urin is discharged from the bladder
9. nourishment
10. muscles that extend or straighten some part of the body
11. tube carrying urine from kidney to bladder
12. opposite of no
14. shape of peak of a volcano
15. enzymes that change maltose to dextrose
19. unit of work or energy in metric system
21. a part of a curved line
22. charged atom
23. structural and functional unit of the nervous system
24. device for taking photographs
26. having to do with the spine
27. band of nerve fibers that connect the cerebrum, cerebellum, and medulla oblongata

Down

1. of or like water
2. lower part of alimentary canal
3. any bundies of fibers connecting body organs with CNS
4. the act of cutting off air supply
5. branched part of nerve cell
6. vessel that carries blood away from heart
7. symbol for lanthanum
13. of or near the heart
14. transparent tissue forming the outer coat of the eyeball
16. of the senses or sensation
17. the nerve connected directly with the brain
18. formed by the fermentation of lactose when milk sours
20. main part of nervous system
25. abbreviation for Monday

LIVING UNITS



CROSSWORD PUZZLE
No. 4

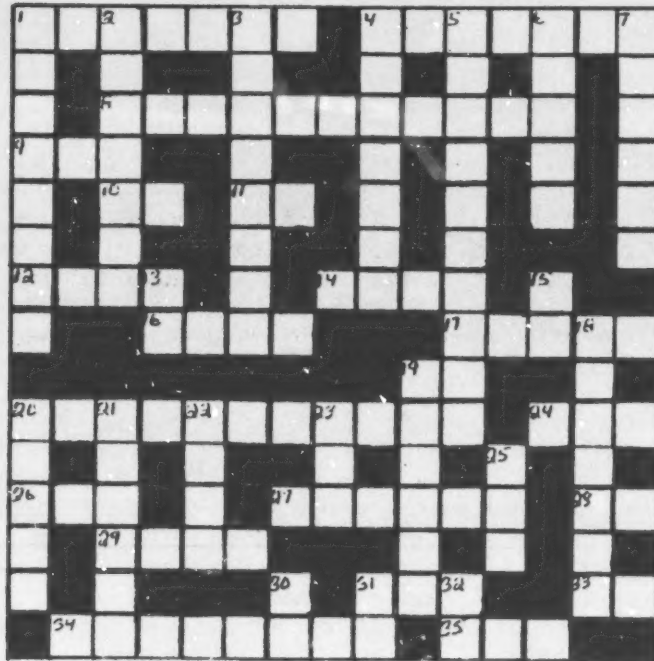
Across

1. destructive metabolism
4. cells were first seen in this
6. scale for acid to base
7. stage of cell division following anaphase
9. part of cell which breaks down large molecules to small
12. a cytoplasmic often pigmented body in cell
15. yellow pigment occurring in certain plant and animal products
17. to get the meaning of something written
18. opposite of lose
19. chlorophyll-bearing body
22. chromosomes are made up of these-transfer traits
23. negatively charged part of atom
24. adenosine diphosphate

Down

1. base pair with guanine in DNA
2. smallest structural unit of matter
3. contraction of it is
4. duplicated chromosome
5. founder of bacteriology
10. large body of water
11. chief substance of plant cell walls
13. insect in earliest stage of development
14. fibers which appear in cell during metaphase
16. submicroscopic infective agents that cause various diseases
18. H₂O
19. hair-like projections of some cells
20. adenosine triphosphate
21. deoxyribonucleic acid

ORGAN SYSTEMS



CROSSWORD PUZZLE
No. 5

Across

1. windpipe
4. of the thin serous membrane lining each half of chest cavity
8. process of aerating - or to oxygenate
9. gorilla
10. blood type
11. rhenus factor
12. pigmented membrane surrounding the pupil of the eye
14. passage leading out
16. Easter plant
17. dependent on a tide or tides
20. any of the small subdivisions of the bronchia
24. part of curved line
26. an oriental sauce
27. in absence of oxygen this substance formed as glucose is only partially broken down
28. valves between atrium and ventricle
29. breathing structure of fish
31. basal metabolic rate
33. symbol for selenium
34. not external
35. opposite of cold

Down

1. moving body of air at each normal breath
2. the sum of all _____ constitutes the lungs
3. opposite of internal
4. the throat
5. covering of windpipe when swallowing
6. of or near the kindeys
7. at upper end of trachea - contains vocal cords
13. Free one "SL"
15. abbreviation for Idaho
18. lungs contain these
19. dividing part of nostrils
20. forming the base
21. necessary for life
22. opposite of warm
23. female germ cell - more than one
25. frozen water
30. symbol for zinc
32. rhenus factor

Nature Goofs

Type of Game: Nature Categories

Grades: 3 and up

Play Method: Oral individual

Call on each player in rotation. As a player fails to name a required word, names an incorrect one, or repeats one already named, write his name on the blackboard and write a G after it. Every time that player misses, an additional letter - O, O, F - is added. When he becomes a full GOOF he is out of the game. He can however, erase a letter by volunteering a word during the volunteer periods in the game.

Reading Directions

In this game we are going to name as many words in a certain nature category or group as we can. For example, I might give the classification *trees*. Each player in turn must name a kind of tree. When a player cannot do so, he becomes a fourth of a GOOF. For every miss a player makes, a letter of the word GOOF is written after his name. A full GOOF is out of the game. But a player can erase a part of a GOOF by volunteering a correct word when one is called for. For example, if several players in a row miss, I will ask for volunteers out of turn. If you can give a correct word at that time, you can erase one of the letters. In that way you may be able to keep yourself from being eliminated from the game.

After the volunteer period, I will give a new classification such as *birds*, *snakes*, *animals*, or *fish*. We will begin again with the player whose turn was coming up. One more thing - if you can volunteer an answer but don't have a GOOF letter to erase, you can have a credit point to use in case you miss on your next time around. Just like money in the bank!

Let's try to keep the game moving as fast as possible. Ready?

Note: With younger children, change the classification often.

Teacher Reference List

Trees

acacia
aspen
beech
black cherry
black walnut
buckeye
catalpa
cottonwood
cypress
fir
ginkgo
hemlock
locust
magnolia
maple

mulberry
oak
pecan
pignut hickory
pine
redwood
sassafras
spruce
sweet gum
sycamore
tulip poplar
willow

Birds
blue jay

buzzard
cardinal
dove
duck
eagle
falcon
flamingo
flicker
flycatcher
goldfinch
grackle
gull
hawk
heron
hummingbird

junco
lark
loon
owl
pigeon
purple martin
redwing blackbird
robin
sparrow
starling

Fish
bass
bonito
catfish

dogfish
flounder
guppy
haddock
hake
halibut
herring
lamprey
marlin
minnow
perch
pickerel
rainbow trout
salmon
shad
sturgeon
sunfish
tiger fish
trout
tuna
walleye

Mammals
anteater
antelope
ape
armadillo
buffalo
bull
cat
chimpanzee
civet

cow
deer
dog
dolphin
koala
kudu
leopard
lion
manatee
monkey
otter
platypus
seal
sheep
tiger
walrus
whale
zebu

Snakes
adder
boa
bull snake
chicken snake
cobra
copperhead
diamondback
grass snake
king snake
milk snake
moccasin
python

rattler
sidewinder
viper
worm snake

Cultivated Flowers
ageratum
amaryllis
aster
azalea
begonia
calendula
Canterbury bell
crocus
daffodil
daisy
forget-me-not
geranium
hibiscus
hollyhock
hyacinth
iris
Johnny-jump-up
larkspur
lavender
marigold
mock orange
morning glory
peony
pink
poppy
rose
tulip

Wildflowers
adder's-tongue
aster
black-eyed
Susan
bloodroot
buttercup
chickweed
clover
coneflower
cowslip
dandelion
day lily
Dutchman's-
breeches
Indian paintbrush
lady's slipper
mallow
mayapple
Queen Anne's
lace
self-heal
skunkweed
spring beauty
sticktight
thistle
touch-me-not
violet
wintergreen
yarrow

Variation: Play as a spell-down type of game and organize two teams. The first player names the category and gives an example. The second player continues in that category. After a certain number of examples, the next player names a new category and gives an example. Write the words used on the blackboard to avoid duplication. Score a point for each correct word. With younger children, limit the play in each category to six examples. With older players, allow each classification to run for ten or twelve examples before the change.

SCIENCE AND NATURE GAMES ¹

Animal Alphabet

Type of Game: Animal Names

Grades: 1 and up

Play Method: Individual oral or written team

As an oral individual game: Call on volunteers to name an animal for a letter of the alphabet. Write the letters on the blackboard in columns. A player may volunteer for any letter not already covered.

As a written team game: Allow five minutes to see how many letters of the alphabet a team can name an animal for.

Reading Directions

I have printed the letters of the alphabet on the blackboard. Let's see if we can name an animal for every letter of the alphabet. Raise your hand if you can name an animal that begins with a particular letter. We will stick to four-legged animals and not include sea animals. It is not necessary that we fill in the letters in alphabetical order, but let's try to find an animal for every letter.

At the end of the game, we will copy the letters we could not find names of animals for. Ask your friends or parents, or visit the library. Then, tomorrow, we will see if we can fill in the blanks.

Teacher Reference List (Animal Alphabet)

- A aardvark, agouti, alpaca, anteater, antelope, ape, armadillo
- B badger, bat, bear, beaver, bison, bobcat, buffalo, burro, bush baby
- C camel, cat, cheetah, chimpanzee, chipmunk, civet, coati, coyote
- D dachshund, Dall sheep, Dalmatian, deer, dog, donkey
- E eland, elephant, elk, emu
- F ferret, field mouse, fitchit, flying lemur, flying squirrel, fox, fox squirrel
- G gerbil, gibbon, giraffe, gnu, goat, gopher, gorilla, groundhog, guinea pig
- H hamster, hare, hedgehog, hippopotamus, horse
- I ibex
- J jackal, jackass, jack rabbit, jaguar
- K kangaroo, koala, koba, Kodiak bear, kudu
- L lemur, lemming, leopard, llama, lynx
- M marten, mole, monkey, moose, mouse, jule, muskrat
- N Newfoundland dog, nine-banded armadillo, northern flying squirrel, Norway rat
- O ocelot, okapi, opossum, otter
- P panda, panther, peccary, pig, porcupine, prairie dog, puma
- Q quill pig (porcupine)
- R rabbit, raccoon, rat, red bat, reindeer, rhinoceros, ringtail
- S sheep, shrew, skunk, sloth, squirrel
- T tapir, tarsier, tiger

U Utah prairie dog
V vampire bats, varying hare, Virginia deer, vole
W weasel, wolf, wolverine, woodchuck
X
Y yak, yellow-bellied marmot, yuma
Z zebra, zebu

Note: There are no animals for X, but let the players find this out for themselves.

Scientific Search

Type of Game: General Science

Grades: 4 and up

Play Method: Written Team

Divide players into small teams, each with a captain-secretary who records answers and makes his own contributions as well. This game could lead into a lesson in man's dependence upon his environment and the necessity for conservation of natural resources of all kinds.

Reading Directions

This is a science game to test your imagination, your powers of observation, and your knowledge of science. Look around the room, look at your classmates. How many things in the classroom can you find that originally came out of or grew in the ground, or came from animals that lived on the ground, or in the sea? It may be something that is part of the room itself. It may be something that someone is wearing. List all the things you can find in five minutes. Not all the things will be in their pure form. They may be combined with another. A pencil of wood that came from a tree contains graphite, a non-metallic mineral that came from the ground. Others may be combinations of things that came from the ground. For example, glass is made of sand, soda or potash, and metallic oxides. Steel is a compound of iron and carbon with varying amounts of other minerals mixed with it depending upon the qualities desired. The addition of nickel and chromium produces hardness and resistance to rusting.

By using your knowledge of the composition of certain materials found in the room, you can come up with a long list in a short time.

What you name may be something you are wearing such as a silver ring with a turquoise setting. Or it might be a woolen sweater made from the wool of a sheep or an Angora goat. Or it might be a cashmere sweater made from the wool from goats of Kashmir or Tibet.

Look hard. Think! There are many objects you can name, some with simple explanations, others with more complicated ones. Talk it over with your teammates. You will be able to help each other.

Note: The reference list is more general than specific but should be helpful. Some of the things listed may not be in the classroom in their original form, but may be combined with one or more of the others. This list supposes that for some players the classroom may be the science room which will contain many of the substances listed either as specimens, parts of a collection, as part of the equipment. Synthetics are included in the list since they are so prevalent.

With younger children the lists compiled will be more specific than general and much simpler in content.

Teacher Reference List

I. Things that Came Out of the Ground

1. Building Materials (Manufactured from Natural Materials)
 - a. cement - an artificial stone made from limestone, shale, gypsum
 - b. concrete - made from cement, sand, crushed rock, and water
 - c. synthetic materials - vinyl tile, synthetic paints, synthetic rubber tiles (see composition of synthetic materials under that classification)
2. Building Stones (Natural)
 - a. granite
 - b. limestone
 - c. marble
 - d. sandstone
 - e. slate
3. Clay
 - a. bricks
 - b. ceramic vases, dishes
 - c. modeling clay
4. Coal
 - a. used for heat
 - b. part of a rock collection
 - c. used in manufacture of synthetics
5. Fossils
 - a. as part of a collection
 - b. chalk, a fossilized substance
 - c. petrified wood gem
 - d. limestone often packed with small fossils
6. Gem Stones (Semi-precious and Precious)
 - a. as stones set in jewelry
 - b. as part of the science room collection

agate	jade	rock crystal
amethyst	jasper	ruby
bloodstone	jet	sapphire
carnelian	lava rock (obsidian)	topaz
diamond	moonstone	tourmaline
emerald	onyx	turquoise
flint	petrified wood	zircon
garnet	quartz	
7. Metallic Minerals
 - a. as specimens in a collection
 - b. as used in jewelry
 - c. as used in building materials
 - d. as used in specific objects, as mercury in a thermometer
 - e. as used in alloys

aluminum	iron	tin
chromium	lead	uranium
copper	mercury	zinc
gold	silver	

8. Natural Gas
 - a. used as fuel, for cooking, in the Bunsen burner, etc.
9. Nonmetallic Minerals
 - a. alabaster - for ornaments, bookends, etc.
 - b. asbestos - as a fireproofing material in curtains, roofing, insulation
 - c. borax - used in making glass, enamels, in chemical experiments, etc.
 - d. chalk - as writing material for blackboards (it is interesting to note that chalk is composed of white, soft, shells of small sea animals)
 - e. chlorine - used for purification of water and for bleaching purposes
 - f. gypsum - used in paints, cement, plaster, tile, and other building materials
 - g. graphite - the "lead" in pencils, also used for brushes in motors, and as a lubricant
 - h. halite - (common salt) used for seasoning food, in the manufacture of glass, in soapmaking, and in metallurgy
 - i. iodine - a by-product of salt, used for medicinal purposes
 - j. mica - used for windows in stoves and ovens, and in electronic equipment because of its high electrical resistance
 - k. quartz - used in making glass and as a gem
 - l. sulphur - used in making matches, in papermaking, and as a source of sulphuric acid
 - m. talc - used in cosmetics (face and body powder), as a filler in paint, rubber, and paper
10. Petroleum (Commonly called Oil)
 - a. asphalt type - used in building roads, in the manufacture of building products such as asphalt tiles and roofing compounds
 - b. paraffin type - as a fuel for heating, as a fuel for internal combustion engines, in the manufacture of wax for candles, crayons, etc.
11. Sand
 - a. in the manufacture of glass, building materials, roads, etc.
12. Water
- II. Things that Grow in the Ground
 1. Nonwoody Plants
 - a. grains, nuts (peanuts used for many products as well as for eating), root vegetables, ornamental plants, etc.
 2. Trees
 - a. wood products used for building products, furniture, toys, pencils, paper-making, etc.
 - b. trees whose specific products are rubber, resin, chicle, coffee beans, fruits, nuts, etc.
- III. Animals that Grow on the Ground or in the Sea
 1. Animals - used for food, hides for leather, pelts for furs, hair for brushes, bristles for brushes, wool for clothing, wool for felt in erasers, hides, hoofs and bones used in making glue and musilage
 2. Fish - in aquarium, fish used to make glue, used for food for people and animals
 3. Shells

- a. abalone (a mollusk) used for food and for the shell which is used for jewelry and decorative purposes, for mother-of-pearl buttons and belt buckles
- b. crushed shells used for planting material for flowering bulbs and in aquariums, also for roads
- 4. Sponges - the internal skeleton of various marine animals with the ability to absorb water

IV. Synthetics

1. Building Materials

- a. synthetic rubber - made from hydrocarbon substances such as petroleum, alcohol, coal tar, natural gas, and acetylene - used for pencil erasers, rubber soles and heels, rubber bands, floor coverings

2. Clothing

- a. nylon, Orlon, rayon - synthetic fibers made from coal, water, natural gas, oxygen, nitrogen
- b. synthetic gems - made by chemical rather than natural processes used in costume jewelry, as watch jewels, etc.
- c. synthetic leather - a fabric base coated with synthetic material

3. Miscellaneous

- a. pressure-sensitive materials such as Scotch tape, made of synthetic material coated with adhesives made from gum arabic, a complex organic material from trees

Variation #1: Give the players words such as ink, paste, pencil. See how many components come from the earth, grew in it or came from animals that lived on the earth or in the sea.

Teacher Reference List

- 1. Chewing gum - from chicle, the latex of a *spodilla* tree
- 2. Glue - made from animal skins, bones, hoofs boiled to a jelly-like substance; also made from fish
- 3. Ink - from lampblack mixed with glue, tannic acid, or gum, and mixed with aniline dyes for color
- 4. Envelope - made from paper and treated with an adhesive. Paper is made from wood pulp (some with rag content)
- 5. Paste - made of a mixture of flour, water, starch, sometimes with alum and resin
- 6. Shoelace - made from rayon or cotton with a metal tip, sometimes from leather
- 7. Silk scarf - from a fiber produced by the silkworm in making its cocoon
- 8. Wooden ruler - made from wood, metal for the strip (usually brass), printed with ink

Variation #2: Give key words such as buttons, belts, jewelry. See how many different materials players can name which these articles can be made from. For example, buttons can be made from leather, bone, shell, wood, synthetics, metal, and glass.

Spelling Baseball Game

Type of Game: Spelling

Grades: 3 and up

Play Method: Oral team

This is a combination spelling and baseball game, so it is necessary that the children understand the game of baseball to play it. Draw a baseball diamond on the blackboard and, below it, a score card showing five innings. Divide the group into two teams. One team is "at bat," the second is "in the field." Using a graded* spelling list, give a word to the first player, who will attempt to spell it. If he spells it correctly, he scores a hit and goes to first base. (The player stays in his place, but a marker is placed on first base on the diagram.) A misspelled word is an out, but only if the team in the field recognizes it as misspelled. If no protest is made by the fielding team, the player goes to first on an error, advancing the first "runner" to second. At the end of three outs (recognized misspelled words), the teams change sides, and the runs scored in that inning are shown on the score card. At the end of three or five innings, depending upon how much time you have, the winner is declared.

Note: A flannel board will work better than the blackboard to keep "runners" on base. But if you have no flannel board, make cardboard markers and place a ring of masking or Scotch tape on the back of each one and stick it to the blackboard. Move it around as necessary.

Reading Directions

This is a spelling game played like baseball. We have a team at bat and one in the field. I will pitch a word to the first player at bat. He will spell it. If he spells it correctly it is a hit, and I will put a marker at first base. If a batter misspells a word and the team at field knows he has spelled it incorrectly, the batter is out. But if the fielding team does not recognize the word as incorrectly spelled, the batter goes to first on an error. Every player has to be on his toes

We will play three or five innings, depending upon how fast the game moves along. The team with the bigger score wins, just as in baseball. I will keep track of the errors, too, so you will know how many errors each team scored. Ready?

Variation: Play in the same manner as described in the rules, but place three chairs at the front of the room. These are designated as first, second, and third base. As a player makes a "hit," he moves from his seat to first base. He advances as his teammates also make "hits." A runner moves from third base to his own seat, scoring a run.

- * Note: Science teachers will want to use specialized spelling lists of science and nature words applicable to the grade level.

¹ Margaret E. Mulac, "Animal Alphabet," p. 69; "Scientific Search," p. 71; "Nature Goofs," p. 77; "Spelling Baseball Game," p. 93. *Educational Games for Fun*, copyright 1971 by Margaret E. Mulac. Reprinted by permission of Harper & Row, Publishers, Inc.

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Suggested Periodicals:

Current Science
National Geographic
Natural History
Readers Digest

Science World
Scientific American
Texas Parks and Wildlife
Today's Health